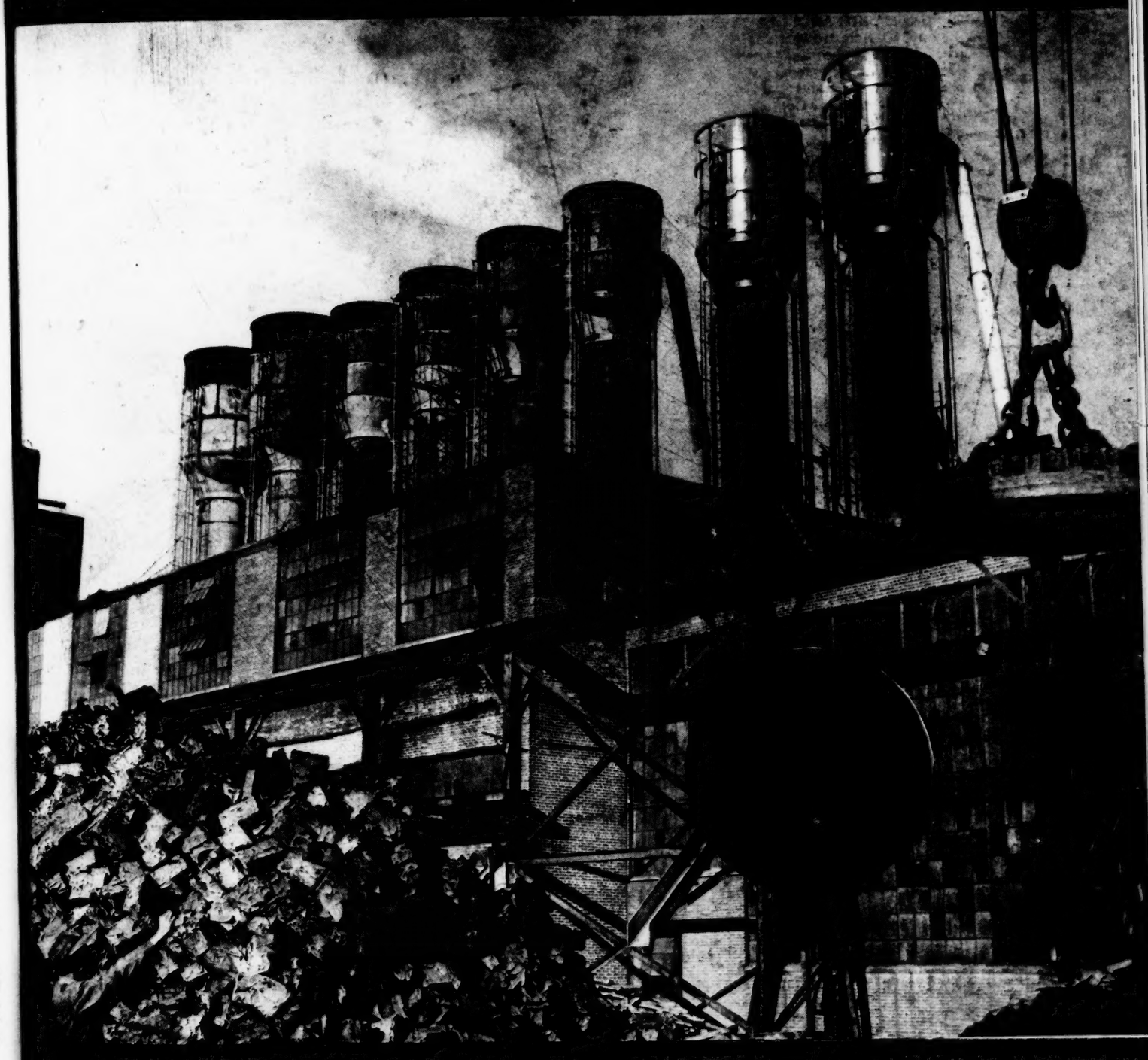
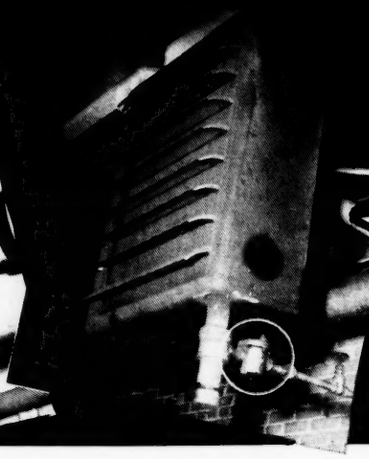
HEATING AND VENTILATING



hot and healthy!

NO MAINTENANCE IN 6 YEARS
on 350 Armstrong traps draining 15 lb. heating system, including unit heaters, coils, radiators, steam mains and headers.
Plymouth Shoe Company, Middleboro, Massachusetts



10-15% REDUCTION IN HEAT-UP TIME, trap maintenance costs reduced 50%, since installing Armstrongs to drain the 5 psi heating system to a 10" vacuum return at *John Deere Ottumwa Works, Ottumwa, Iowa.*

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HEATING AND VENTILATING

A MONTHLY MAGAZINE FOR ENGINEERS AND CONTRACTORS CONCERNED WITH THE DESIGN AND APPLICATION OF AIR CONDITIONING, REFRIGERATION, PIPING, AIR SANITATION, HEATING AND VENTILATION IN BUILDINGS

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The contents of HEATING AND VENTILATING are indexed monthly by Industrial Arts Index and by Engineering Index.

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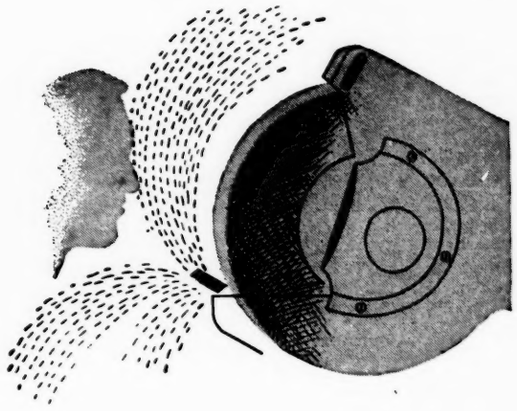
PUBLISHERS OF MACHINERY & MACHINERY'S HANDBOOK
The INDUSTRIAL PRESS

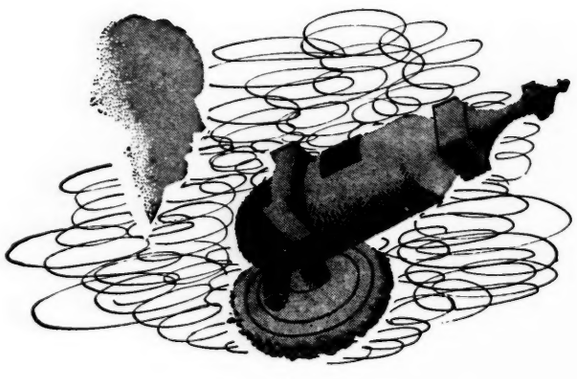
THIS MONTH'S COVER

Wet dust collectors on two Number 12 and six Number 11 cupolas at Pontiac Motor Division, General Motors Corporation.

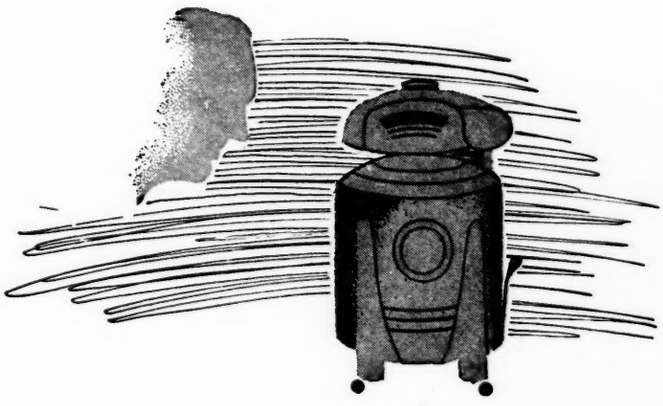
they're strong for standardization



Electrical Engineer, machine tool company, says: "I think designers will save time in the long run if they decide, at the start of a job, to use standard motors. We'll eliminate exhaustive engineering tests we used to make on fractionals. With horsepower, service factor, breakdown torque, and starting current all rated on a clear-cut, uniform basis we'll know *in advance* that the motor will do the job."



Chief engineer, portable tool plant, says: "I simplify design when I specify series-motor parts with NEMA standard dimensions for our portable tools. By designing tool housings to take parts conforming to these standards, I simplify case construction, obtain interchangeable motor design, and lower overall costs."



Vice-President, washing machine company, says: "The use of *standard* washing machine motors helps our dealers to give dependable service. With standard motors, the service man can take full advantage of the motor manufacturer's motor-exchange and repair-service plans—take the headaches, and delays, out of motor repairs or replacement. He can be sure that the motor he puts back on the job will perform as it should."

Washington News

LORING F. OVERMAN

WITH Members of Congress officially "back home" until January 3, there was added cause for Thanksgiving in Washington during November. Among the causes might be listed:

(1) No last-minute legislation—perhaps later to be regretted—was being rushed through.

(2) Senators and Congressmen were given an opportunity to feel at close range the pulse of their constituents.

(3) Constituents, in turn, were given a breather in which to reform their lines for the coming Congressional session which, many believe, will have an important bearing on whether or how far the country will travel on the road to "welfare statism."

Welfare, or Farewell?

There is great disagreement, depending, of course, upon one's point of view, as to whether today's legislative trend is leading to a welfare state, or to a farewell state. The Administration denies either possibility, but opponents are becoming increasingly vocal in claiming that the pattern follows all too closely Great Britain's experiments in socialization.

Suffice it to say that those who favor the present trend, by whatever name it may be called, will be interviewing their legislators during the holidays. Those of contrary mind are privileged to do likewise. Which side has put up the most convincing arguments will be evident in January when Congress takes up its new program.

"New" Program?

In looking over the "new" docket which the Administration has indicated it will push, it appears that the "mandate" idea still persists, and that no compromise is anticipated. Among the group the Administration considers as "musts" are seven familiar topics:

(1) Taft-Hartley revision;
(2) The Brannan plan to subsidize farmers;
(3) Federal aid to education;
(4) Housing subsidies for middle income groups;
(5) Valley authorities;
(6) Social Security expansion;
(7) Increased taxes.

Despite steel and coal strikes in which many have felt that injunction provisions of the Taft-Hartley law might have been used to advantage, the Administration has indicated that it will renew its fight for repeal — as promised to and insisted upon by labor leaders. If no favorable action is forthcoming in the coming session, the Administration plans to make Taft-Hartley a campaign issue in next November's elections.

The Brannan plan for farm subsidies would introduce a new wrinkle to agricultural price supports. It would continue crop loans on storable commodities, but for perishables it proposes to let prices seek their own market levels and to direct the government to pay the farmer in cash the difference between the price received and a new and higher parity. A compromise farm products price support bill, passed just before adjournment of the last session of Congress, pleases few people, and much pressure for the Brannan plan is anticipated.

House action will be sought on the Senate-approved bill to provide an initial $300 million for Federal aid to states to help pay teachers' salaries. The mentioned figure is considered to be merely a door-opener, with broad expansion of the program likely if first steps are approved.

Having provided subsidies for low-income housing at the last session, similar consideration for middle-income groups is the next goal. Little opposition to this proposal is anticipated, since it will continue and extend many existing provisions of FHA procedure.

Valley authorities seeking to duplicate Tennessee Valley Authority activities—in whole or in part—in nine major river valley areas, will be sought by proponents of the public power idea. Observes one commentator: "The immediate result would be nine monopolies or government trusts, all beyond control by the states and all outside the practical reach of Congress."

Increased benefits and coverage under the Social Security law was authorized by the House at the last session, and will come up for Senate Finance Committee hearings early in January. Another piece of welfare legislation likely to make its appearance contemplates compulsory health insurance.

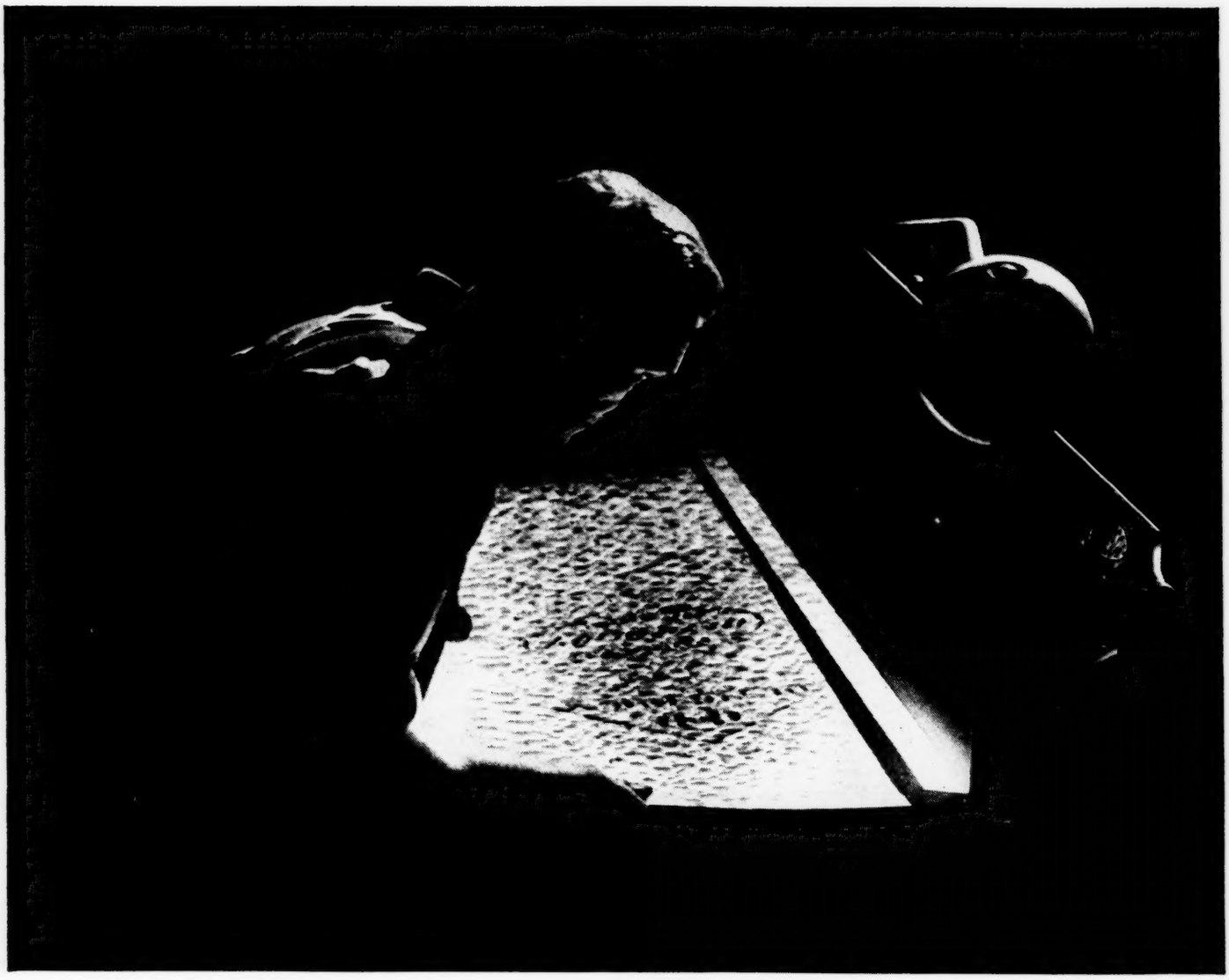
Higher taxes, the Administration has indicated, were asked for last January, and are just as necessary now. With a $5.5 billion deficit indicated for the current year, the need for some sort of adjustment is obvious. Senator Byrd and some other non-conformists suggest that cutting expenses might provide a welcome solution. Logic of this sort will continue to be unpopular in Washington, however, as long as constituents retain the something-for-nothing complex.

New Accounting Method?

So instead of economy, the trend still appears to favor even greater spending, with either deficit financing, or a new and novel form of bookkeeping to make the deficits look less alarming. Rumored as now under consideration is a plan to classify some government expenditures as investments; therefore assets, regardless of the likelihood that they may never be repaid.

Construction Forecast High

Meanwhile, despite doubts and concern over long-range trends, the immediate outlook for the construction industry and its heating-ventilating and air conditioning satellites is favorable. The new government estimate for 1950 construction is $19¼ billion. Increases over 1949 are expected in schools, public housing, hospitals, institutions, highways, reclamation, flood control, sewers and water systems. Decreases



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LAST CONSIDERABLY LONGER

(and cost very little more than ordinary galvanized sheets)

Heating or ventilating ducts made from Beth-Cu-Loy Galvanized Sheets can be expected to last longer than those made from plain galvanized steel sheets.

The principal reason for this long service is the resistance to rust provided by Beth-Cu-Loy's copper-bearing steel base. It is manufactured from open-hearth steel that contains 0.20 to 0.30 pct copper. In atmospheric-exposure tests by the American Society for Testing Materials this composition has proved to have more than double the resistance to corrosion found in ordinary open-hearth steel.

Aside from their lasting qualities, Beth-Cu-Loy Sheets are easy to form, to seam and to solder. They make fast work of difficult jobs. Their very slight additional cost is balanced many times over by their longer life and excellent workability.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by
Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

Beth-Cu-Loy Galvanized Sheets

BETHLEHEM STEEL

are likely for factories, warehouses, private housing, churches, farm buildings, and other classes.

October expenditures for private and public construction set a new record for that month. The total reported on November 23 was $1,856 million — 2% above the previous October record of $1,814 million in 1948. The figure was the highest for the month since 1939, when the Bureau of Labor Statistics began assembling construction data.

Spending on privately financed construction totaled $1,324 million in October, compared with $1,338 million in September and $1,355 million in October, 1948. Home building expenditures totaled $695 million in October of this year, compared with $680 million in September and $670 million in October, 1948.

Housing Proves Surprise

A surprise contribution to the construction total for October was an unexpected 100,000 "starts"—a record for the month—and basis for current estimates that 950,000 non-farm dwelling units will have been started this year. The closest previous annual total was 937,000, reported in the construction-boom year of 1925. Last year the total, including rental units, was 931,000.

The official home building forecast for 1949 — announced last November—was 875,000 starts. Through June it appeared that the forecast would prove accurate, but in August an upturn was noted. Starts in August totalled 98,000 compared with 86,000 last year. Preliminary figures placed the September total at 100,000, compared with 82,000 during the same month in 1948. Then came the October data, refuting all previous evidence that home construction is a spring and summer enterprise.

To find out why the home construction market has taken such a radical upturn—and to answer many other puzzling questions—the Bureau of Labor Statistics is conducting a survey employing 200 workers in 15 key cities. Interviewers are asking questions about price, quality, financing — answers to be published early next year in a new series of housing reports. Reports will be made on the type of materials used, floor space, number of windows and doors, and what facilities are provided — including air conditioning, garbage disposal units, and other equipment.

Occupants will also be asked about down payments, financing charges, insurance provisions, and family income. The new data is expected to reveal facts not now included in BLS statistics. These reflect construction costs, usually including the builder's profit, but customarily omit land costs and such miscellaneous charges as landscaping.

The new survey is expected to verify preliminary indications that apartment houses and multi-family dwellings are accounting for an increasingly high percentage of total residential building. In the first six months of 1949 an estimated 125,900 of these two-or-more family dwellings were started—an increase of 19% over the same months last year. Conversely, there was a 10% drop in the number of single-family dwellings.

Also reported is a noticeable pickup in the number of publicly financed dwellings in 1949. During the first 10 months of 1949, 32,700 homes were built with public funds—2½ times the 12,000 started during the first 10 months of last year.

Code Revision Again

With the Housing and Home Finance Agency completing its staff and getting ready for full-scale operation in slum clearance and community redevelopment projects authorized by the Housing Act of 1949, Administrator Raymond M. Foley continues to stress the need for improved building and other local codes.

"The Act contemplates postive action by communities to improve their local building codes and other regulations along with elimination of unnecessary restrictive requirements that prevent housing cost reductions," Mr. Foley said. "This does not mean, of course, that the Government is requiring a complete, overnight revision of codes as qualification for Federal assistance. The HHFA is fully aware of the fact that time is required for such revision and that code improvement is a continuous and complex matter."

Under the housing research provisions of the Act, he explained, the HHFA is undertaking a broad scale program designed to provide essential technical and legal information needed for code improvements. This information will be made available to local authorities for adaptation in making code revisions.

A Word About Fuels

During the closing week of November it appeared that, barring unlikely new production stoppages, supplies of coal, oil and gas would be sufficient to meet normal winter requirements.

Observers were of the opinion that miners would stay in the pits, and that supplies would soon catch up with demand. Industrial supplies were not greatly depleted by the no-day weeks in the mines, and the Interstate Commerce Commission's authorization for full service on coal-burning railroads was accepted as evidence that no immediate shortage is imminent.

Availability of transportation also permitted the conclusion that there would be an adequate supply of oil, with the possible exception of heavy fuel oils in Eastern regions. The supply situation could be upset, however, by any heavy conversion to oil, or if transportation were long interrupted.

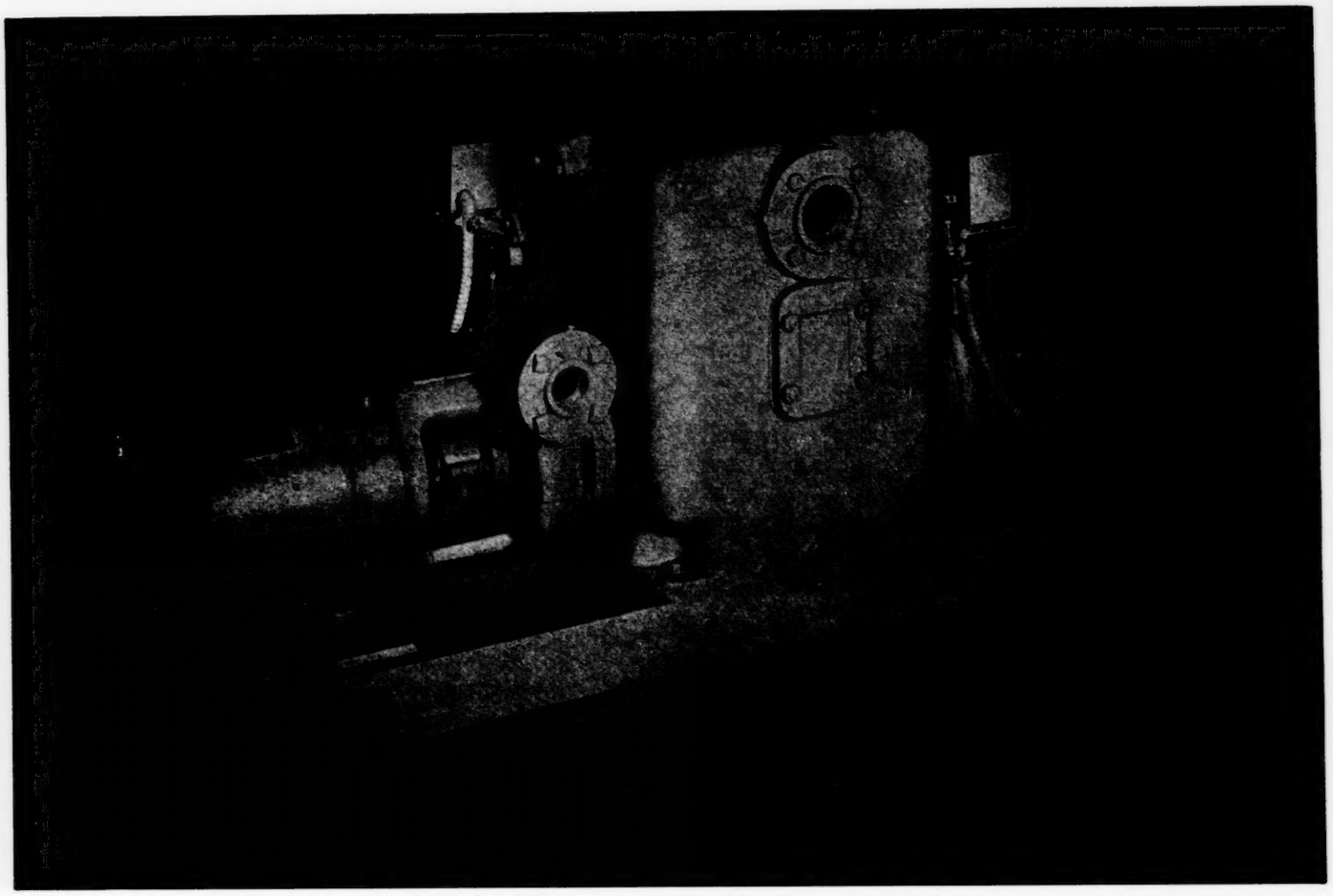
Natural gas supplies are reported as reflecting the addition of new underground storage facilities, as well as opening of 5,000 miles of new pipeline during the first half of 1949.

Washington Miscellany

September production of heating and cooking equipment continued an upward seasonal trend, with important increases over August reported for practically all types. *Industry Report 671, Census Bureau, Commerce Department, Washington 25, D. C.*

A tabulation of the total cost of fuels and electrical energy consumed for power and heat by manufacturing establishments during 1947 is included in *Census of Manufactures Series MC100-9, Census Bureau, Commerce Department, Washington 25, D. C.*

MAXIMUM EFFICIENCY FOR STEAM HEATING SYSTEMS ON HEATING, DRYING AND PROCESS WORK.



JENNINGS CONDENSATION PUMPS

Designed for steam systems on heating, drying, or process work, these pumps offer the most reliable and efficient means of returning hot condensate to boiler or hot well. In many cases these pumps will save costly installation of boilers in a pit to provide gravity flow of returns from basement radiators and heating devices.

The Jennings Condensation Pumps are sturdy and compact in construction, and combine receiving tank, pump and driving motor in a single assembly. Pumps are bronze fitted throughout, with tobin bronze shaft. The pumping impeller is of special design, made possible by our wide experience with return line heating pumps, and is especially adapted for handling hot water with the greatest possible efficiency.

Full automatic control is furnished by means of a ball float and float switch mechanism mounted on the receiving tank. All wiring is made up at the factory, and it is necessary only to connect the pump to the system and hook up the leads. Complete information regarding these economical pumps sent promptly on request.

THE NASH ENGINEERING COMPANY

SOUTH NORWALK, CONNECTICUT, U. S. A.

HEATING, VENTILATING AND AIR CONDITIONING THE Secretariat of the United Nations

E. J. BENESCH
Engineer, Syska & Hennessy, Inc.
New York, N. Y.

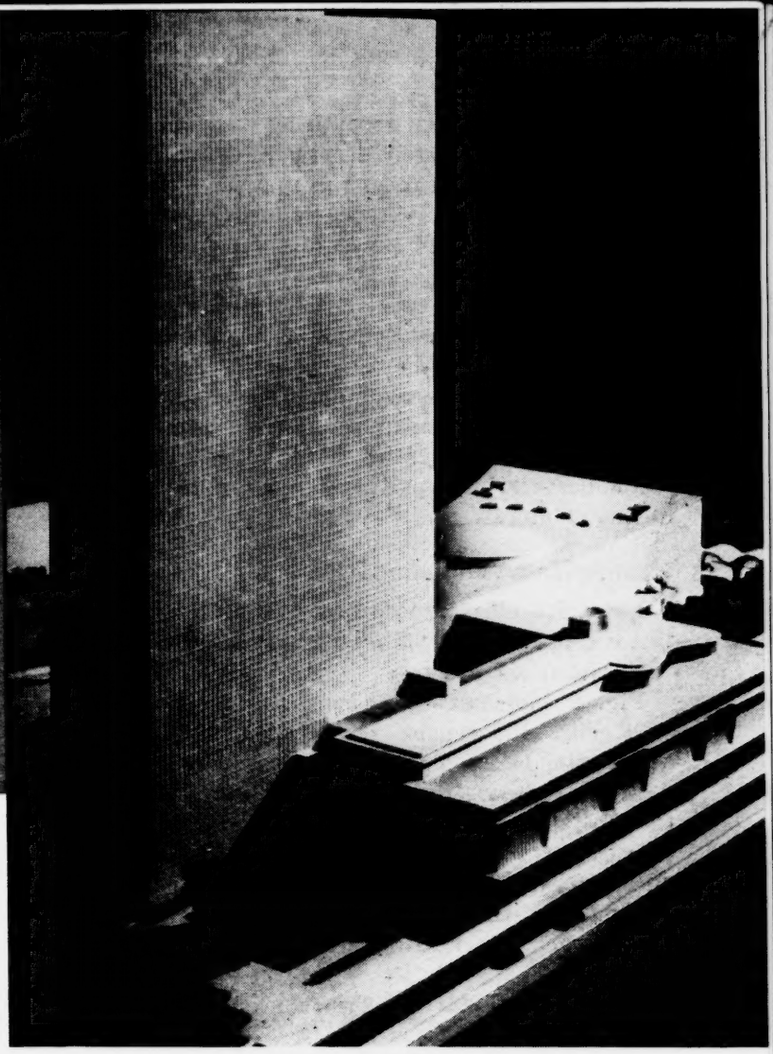


Fig. 1. Model of the UN Permanent Headquarters.

Considerable interest has developed in the Secretariat, the first of a group of five buildings to be completed as permanent headquarters for the United Nations. In this article are described the design features of the heating, ventilating, air conditioning and control systems of the Secretariat.

FIVE impressive, awe-inspiring buildings will provide the United Nations Permanent Headquarters in New York City. The Secretariat, which is the edifice now towering over 42nd St. at the East River, is the workshop of the United Nations; all the preparatory work for the general assembly, the councils and committees will be done in this building. The meeting halls contain the six council chambers and committee rooms. The General Assembly houses the assembly hall in which the yearly sessions of the General Assembly will take place, and the various studios for recording and broadcasting the work of the assembly. The parking areas are underground garages for the cars of the United Nations, personnel and visitors. The present Manhattan office building which houses the Planning Office and other UN offices at 405 East 42nd St., will become the library of the United Nations. The FDR Drive is to be covered by an extension of the UN headquarters between 42nd and 48th Streets.

The Secretariat office building has 39 stories above street level and three stories below. It is 505 ft high, 287 ft long, and 73 feet wide; it contains 13,500 tons of structural steel and 5,200 heat-absorbing glass window units. The east and west facades are composed of grids of aluminum and glass, and the north and south walls are faced with gray Vermont marble. The building will have 500,000 sq ft of space for offices, served by 20 high-speed elevators, and a pair of escalators serving the first five floors.

Above the first floor, the story height is 12 ft. The general ceiling height is 9.5 ft with 9 ft 3 in. under the girders. The 73 ft width, together with the relatively high maintained ceiling height, posed a problem of how to run ducts and piping.

Building Has Five Zones

Mechanically, the Secretariat is divided into five vertical zones. The three basement levels and the first floor comprise one zone, which is supplied from several isolated mechanical equipment rooms. The second to tenth floors have a pipe gallery, or mechanical equipment room on the sixth floor; the 11th to 21st floors are supplied from the 16th floor pipe gallery; the 22nd to 33rd floors from the 28th floor pipe gallery; the remainder of the building from the 39th floor.

The location of the various pipe gallery floors was determined by the overall mechanical equipment requirements; namely, the elevator transfer floors, the house tank requirements, transformer vault location on the 28th floor, the air conditioning and ventilating duct areas, and the size of the chilled water risers.

No single type of heating system was employed in the Secretariat. The north and south walls, with its absence of windows, are heated by hot water wall panels; the first floor by hot water floor coils and warm air; the pipe galleries by steam unit heaters; the typical floors by hot water circulated through the window units; steam convectors are installed in scattered spots.

Steam is supplied to the Secretariat by the New York Steam Corp. from two 24-inch mains in 42nd St.,

and the steam meter room is at the 42nd St. wall. Steam at approximately service pressure is extended to the refrigeration room for operating the refrigeration compressors. Pressure reducing valves are set at the minimum line pressure to insure steam at a fixed pressure for the turbines.

From a 100 lb per sq in. header, steam is distributed to the mechanical equipment rooms throughout the entire project. In the pipe galleries and equipment rooms, pressure is reduced to 5 lb per sq in. for heating stack and converter operation, and 40 lb per sq in. for domestic hot water heating service. Converters are hot water heaters for supplying the Weathermaster units during winter.

Heating and Ventilating

Extensive glass exposure of the first floor necessitated supplementing the floor panel heating system with warm air heating.

Fig. 2 indicates the general arrangement of the wall coils. Floor panel design was based on a 50F differential between indoor and outdoor temperature. A master outdoor thermostat and a sub-master room thermostat maintain the indoor temperature. For winter weather, return air thermostats control the air conditioning system reheater coils.

First floor entrance vestibules are heated by individual warm air heating systems automatically controlled.

Stopping and starting the fans of all unit heaters are thermostatically controlled.

All panel heating coils are light weight steel tubing (Rayduct) tested at 300 lb per sq in.

The north and south walls are insulated. Wall coils, Fig. 2 and 3, are used to offset the cold radiating surface. Control is by an outdoor thermostat which governs the converter steam valve.

All unconditioned interior areas are mechanically ventilated. Elevator machine rooms have independent supply and exhaust systems. The steam room is provided with supply and exhaust ventilation. Outdoor air is mechanically supplied to an insulated hung ceiling space over the room; air discharges through openings in the hung ceiling to supply the rooms and is exhausted from the rooms mechanically.

Toilet room exhaust air is discharged into pipe gallery spaces. Before being discharged, the air flows through activated carbon to remove odors; the treated discharge air serves as supply air to the equipment floors. Balanced gravity dampers in the east and west walls relieve the pressure built up by this supply air. This arrangement is intended to provide ventilation for the machinery floors, and to eliminate the necessity of extending the toilet exhaust ducts to the roof.

The 28th floor transformer vaults are ventilated by gravity to louvers in the exterior walls.

The unique exterior architectural pattern of the building at the 6th, 16th, 28th, and 39th floors, disguises the various fresh air intakes and exhaust air discharges.

Air Conditioning

The Secretariat may be said to be entirely air conditioned, with comfort cooling in summer, and heating and humidification during the winter. For the exterior areas, there is individual control of cooling and heating. For the interior space, average requirements are provided. The exterior system, as installed, is the Carrier Weathermaster; the interior system is the conventional type.

Interior conditions, during summer operation, have been designed for a maintained temperature of 78F and a relative humidity of 50% at peak conditions, and approximately 76F and 50% R.H. at other than peak conditions at any time. Outdoor conditions do not exceed 75F wet bulb. For winter operation, temperatures of 70-72F were selected, with the relative humidity varying from 50% to that necessary to prevent condensation on the interior surfaces.

Building population was based on an overall figure of one person per 100 sq ft floor areas. The lighting load averages 3 watts per sq ft.

Fresh air was provided at the rate of 20 cfm per person; for the exterior system, not less than one air change per hour.

There are 17 exterior air conditioning systems which handle approximately 191,700 cfm of primary air. Of this amount, 57,300 cfm is outside air and 134,400 cfm is recirculated air. When outdoor conditions permit, 100% outside air may be circulated.

The exterior systems are arranged so that for each group of floors supplied from a pipe gallery, there are two systems for the east side of the building and two for the west side. This arrangement provides for northeast, northwest, southeast and southwest orien-

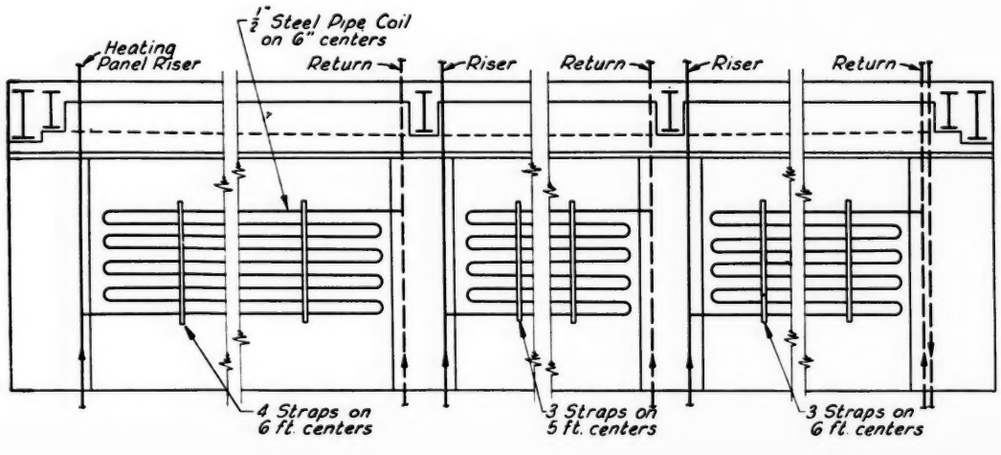
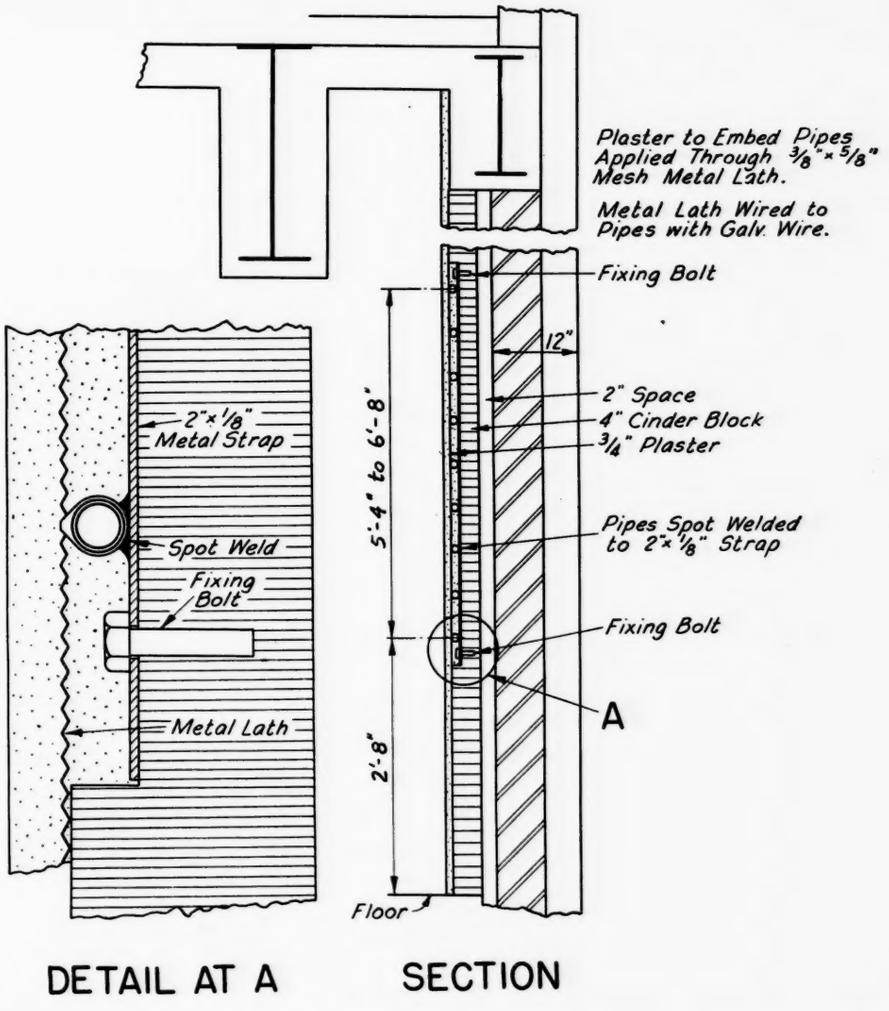


Fig. 2. Details of typical wall heating panels. Mounting details are shown in Fig. 3.

Fig. 3. Section through north and south walls to show the method of attaching the heating panel.



tation. On the average, each system supplies 10 floors, that is, five above and five below.

There are 14 interior air conditioning systems handling a total of 322,500 cfm supply air and 91,200 cfm fresh air. These systems provide not less than six air changes per hour for interior areas. Nine miscellaneous systems serve the remainder of the building with 74,700 cfm conditioned air and 10,500 cfm fresh air.

Arrangement of the interior systems is similar to that for the exterior systems, except that one group supplies the north half and the other group the south half of the building.

Each air conditioning supply system is complete, consisting of a wetted surface type dehumidifier, with face and by-pass dampers, preheaters and reheaters, air filters, distributing ductwork and diffusers. Recirculated air is returned to the dehumidifiers by independent fans and ducts and, in general, the return air systems are common to more than one supply air system. All return air is filtered before being supplied to the dehumidifiers.

Chilled water, containing 30% by weight of ethylene glycol, is supplied to each dehumidifier from the central refrigeration plant. The large number of systems, together with the physical size of the individual dehumidifiers and the initial investment, were the determining factors in the decision to employ an antifreeze in the water circulated to the dehumidifiers.

Two centrifugal refrigeration compressors furnish 2,300 tons of cooling.

Chilled Water System

The general chilled water system is divided into the main and secondary systems. The main system circulates water from the coolers in the third basement to the 39th floor. The secondary systems are fed by the main system and supply the exterior system window unit coils and the dehumidifiers. Interchangers, or mixing valves, separate the main and secondary systems.

The hydrostatic head on the water coolers, due to the height of the Secretariat, is 534 ft; for the dehumidifiers and window units on the sixth floor pipe gallery it is 408 ft, or 175 lb per sq in. To permit the use of standard weight automatic temperature control valves, particularly at the window units, of which there are over 2,600 valves, interchangers are located on the sixth and 16th pipe gallery floors. Automatic mixing valves are used on the 28th and 39th floor pipe galleries since for the systems served from these floors, the excessive head does not exist.

Water at 42F is required for the primary air of the exterior system, and 48F water for the window unit coils. Since, to obtain an interchanger of acceptable proportions, 34F cooling medium is required, ethylene glycol is added to the water to prevent any possibility of icing on the water cooler tubes. Interchangers for the window unit coils are independent of those for the exterior system primary air and interior system dehumidifiers.

Interchangers are of the steel shell and copper tube type. Shells are of flange quality steel and water chambers are removable. Tubes are ¾ inch O.D., No. 18 BWG pure seamless copper. Patterson-Kelley Co. furnished the interchangers.

The secondary systems serving the window units are of the reversed return type. Interchangers on the sixth floor pipe gallery serve down to the second floor and up to the 15th floor. From the 17th to the 27th floors, the 16th floor interchangers are used; the 28th floor interchangers serve from the 29th to 38th floors.

Each system is provided with an open galvanized steel expansion tank fitted with gage glass and external water feeder. Six expansion tanks ranging from 39 to 583 gallons are provided.

Chilled water distributing mains are located at the

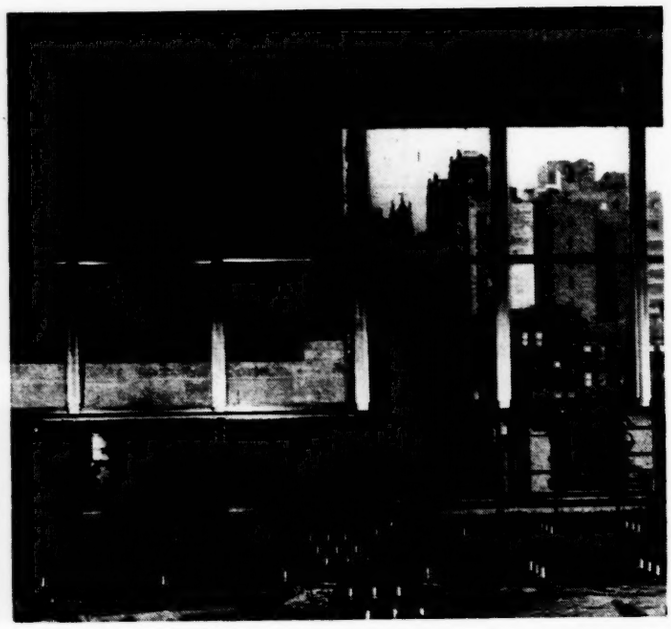


Fig 4. Piping connection details for the window units.

pipe gallery floors. At each exterior building column, risers are installed to supply the window unit coils. Condensate drain risers are grouped with the chilled water risers. In many locations, the mains pierce the structural girders so that headroom may be maintained. Dirt pockets, the full size of each riser, and fitted with a ¾ inch hose gate valve, are installed to facilitate cleaning the system. Branches to the window units are run within and behind the unit enclosure as indicated in Fig. 4. Each branch from the riser has a shut-off valve. Temporary connections to each window unit coil are required for initial cleaning of the piping system so that dirt in the piping will not be deposited in the coils. Automatic float operated air vent valves are located at all points where air binding may occur.

The main chilled water piping system is of black steel, standard weight, 10 inches and smaller, and extra heavy weight for sizes 12 inches and larger. Piping is steel, from the main risers to the interchangers, and from the interchangers to the dehumidifier cooling coils. Copper pipe runs from the interchangers to the window units. Light weight copper pipe with Walseal fittings is used except for unit branches which have type L soft copper tubing with wrought copper fittings. Condensate drain piping is the same as the chilled water piping.

Circulating pumps, which handle chilled water containing ethylene glycol, are of the vertically split case type and are equipped with a Crane bellows type shaft seal. Pumps for chilled water, without anti-freeze solution, are of the horizontal split case type. From the inlet side of the circulating pump, a light weight copper expansion pipe is extended to its respective expansion tank.

There is a complete system for distributing ethylene glycol. From a 1,000 gallon feed tank, the solution is piped through type L copper tubing to the automatic feeder on each expansion tank. A pressure reducing valve with by-pass is installed at each tank. A pump is installed for the main riser tank and operation of this pump is indicated in the engineer's office.

Fig. 5 indicates the general arrangement of the chilled water piping system. It will be noted that for window units above the 28th floor, chilled water is circulated from the main system; all other units are supplied with water not treated with the anti-freeze.

Conditioned Air Distribution

Air distribution to the Carrier Weathermaster window units is arranged horizontally; that is, the customary vertical primary air risers have been replaced with horizontal ducts on the ceiling of each air conditioned floor. This arrangement was necessary so that the exterior building columns could be maintained at a minimum size. The original design, or plan, contemplated rectangular ducts, with an option permitting the use of circular conduit. The option was exercised. For the interior system, ducts of the conventional type and shape are used.

Because of the narrow, 39-story-high Secretariat, deep structural lateral girders are required, ranging from 27 to 33 inches in depth. Intermediate beams average 18 inches deep. A 12 ft story height, together with 33-inch girders, and recessed lighting fixtures, presented a problem regarding maximum finished ceiling height. Edwards and Hjorth, the structural engineers, designed the framing to permit the ducts to pass through the girders as shown in Fig. 6. Steel cuts were studied and restudied. The ducts pass through the center of the girder, rise to the underside of the intermediate beams to pass over the lighting fixture, and drop down to the center of the next girder.

The Secretariat has been designed on a 4 ft module basis with seven modules per bay. Above the sixth floor, the occupancy will be office type spaces. Numerous studies were made of possible partition arrangements at the exterior walls before six Weathermaster units per bay were established. The two units immediately adjacent to the columns were paralleled and automatically controlled as a single unit. The exact location of the controlling valve is to be determined when definite partition locations are established.

Ceiling construction is of the acoustical pan type. Lighting fixtures are of the recessed fluorescent type, 4 ft long and one foot wide, arranged between air outlets in the ceiling. Location of ceiling diffusers, so as to harmonize with the overall ceiling pattern, presented a problem. It was solved by locating the diffusers at the end of the lighting fixture. The diffuser is independent of the fixture. Requirements for the diffuser were that it be one foot square, that its edge match the joint in the ceiling pan and the lighting fixture, that it be removable for cleaning, and that it have a 360 degree air distribution pattern. The air passages could be circular or square. Anemostat type E diffuser was finally selected.

Partition arrangements imposed another problem for diffuser location. It was required that the diffuser could be relocated one foot in either direction without changing the entire branch connection. Two slip type telescopic joints were placed in each branch and the joint sealed with fiber glass adhesive cloth. Filler

pieces, one foot long, are provided to be slipped into place when relocation of the diffuser is necessary.

For the Weathermaster system, American Blower Series 92C fans with Carrier dehumidifiers are being supplied. The dehumidifiers are of all-copper construction with a copper spray piping system and with brass nozzles. Each dehumidifier has an individual spray pump of the vertically split close-coupled type. A ¼ inch O.D. copper tubing waste and valve are installed in each spray discharge to insure a constant supply of fresh water to the dehumidifier pan. For the interior systems, American Blower HS fans and wetted surface all copper dehumidifiers are used, and Nesbitt heating and cooling coils. Recirculated air fans are ABC, type HS. Air filters are provided for all fresh air and recirculated air ducts—systems of less than approximately 10,000 cfm have American Air Filter's air mat with fiber glass media, and those over about 10,000 cfm have American Air Filter automatic filters complete with automatic sprinklers. All fans are belt driven by General Electric constant speed squirrel cage open induction type motors. Vibration bases are furnished under all fans and motors. For the Weathermaster system, fiber glass sound absorbers are placed for each supply fan discharge.

The hung ceiling space is generally used as a return air plenum between the diffusers and the vertical shaft. Each diffuser is fitted with an adjustable damper. Fire dampers isolate the hung ceiling space from the duct shaft.

Automatic Temperature Control

All heating, ventilating and air conditioning systems are provided with pneumatic automatic temperature control.

Panel heating systems are controlled from an outdoor thermostat, located with respect to the particular exposure, to actuate the converter steam valve.

Supply ventilation systems provide outdoor air, the temperature of which is maintained at an adjustable predetermined level by control of the heating coil steam valve.

The chilled water temperature from the interchangers on the sixth and 16th floors to the exterior primary air cooling coils and the interior system cooling coils is controlled to maintain an adjustable predetermined water temperature at the coils by operating a by-pass valve between the flow and return mains at the interchanger. For the 28th and 39th floor systems, a mixing valve controls the amount of 34F water and the amount of return water delivered to the coils at an adjustable predetermined temperature. At each interior system dehumidifier, the flow of 42F water is regulated from the cooling coil supply line to maintain an adjustable predetermined temperature at the coil.

The chilled water temperature from the interchangers on the sixth and 16th floors to the window unit coils is controlled at the interchangers by a bypass valve between the supply and return mains. During winter operation, the supply water temperature controls the converter steam valve. For the 28th floor window unit coils, the control of supply water temperature is by means of a 3-way valve controlling the flow of 34F water. Summer-winter switches are provided on a panel in the engineer's office for the change-over operation.

The condition of the primary air supplied to the window units during summer operation is determined by the temperature of the water supplied to the dehumidifiers. The spray pump is in operation during summer control. During winter operation, supply air temperature is regulated by the maximum outside air damper, and the preheater and reheater steam valves. A sub-master wet bulb thermostat in the return air fan inlet governs spray pump operation for humidity control. During the intermediate season, the spray pumps are not in operation. However, both fresh air dampers are open, a sub-master thermostat controls the reheater steam valve to maintain the supply air temperature, and a master thermostat in the fresh air intake resets the sub-master to lower the supply air temperature as the outdoor dry bulb temperature rises. The change-over for all systems located in each respective pipe gallery is by means of a single master switch on a panel in the engineer's office.

The control of the supply air temperature to the interior systems is similar to that for the exterior systems except that the control is from the average of four room thermostats for each system, and a low limit thermostat will overcall the room thermostats during winter operation. During summer operation, the dry bulb temperature control is from the average of the four room thermostats which regulate the operation of both cooling coil face and by-pass damp-

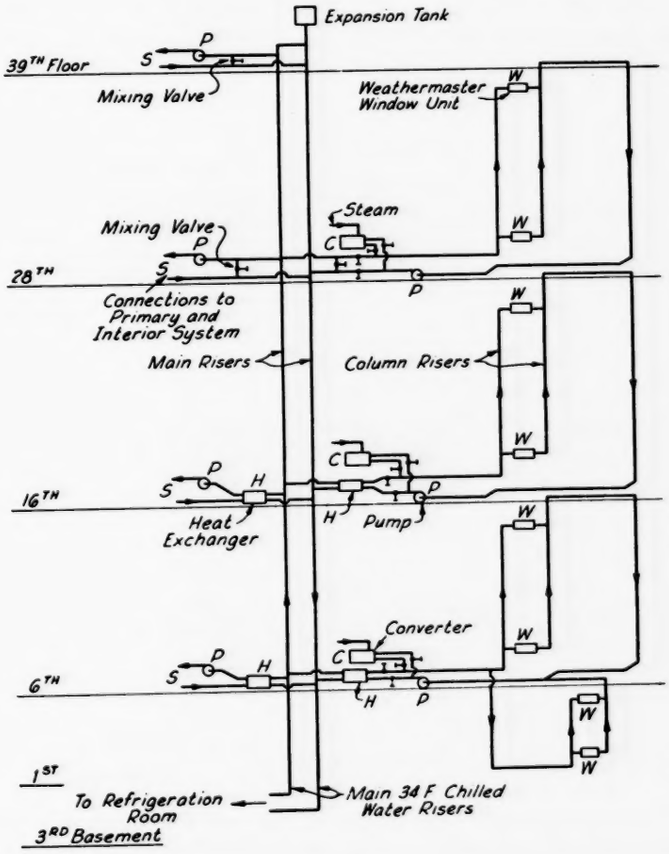


Fig. 5. Chilled water distribution system showing (S) connections to the primary and interior systems, (P) pumps, (H) heat interchangers and (C) converters. At the right of the main risers are the secondary systems with (W) window units.

Fig. 6. Round ducts are run through beams for secondary systems; rectangular ducts serve the primary systems.

ers; a wet bulb thermostat in the return air stream will overcall the dry bulb operation of the face and bypass dampers for humidity control and place the dry bulb control at the reheater steam valve. The spray pumps will be in operation. During the intermediate season the spray pumps are not in operation, the control will be by means of outside air dampers and reheater steam valve. A change-over switch is provided as for the exterior system primary air. A roughing box is placed on each floor served by the interior system. The return line from each roughing box is extended to the pipe gallery serving the respective floors.

Thermostats controlling the window unit coil valves are direct acting during winter and reverse acting during summer. Each thermostat has a remote bulb located in the return air stream of the unit. A handle in the top of each unit enclosure enables the thermostat to be reset through a limited range. The change-over from direct acting to reverse acting is through change of the main supply air pressure to the thermostats. A master switch on the panel in the engineer's office operates valves in the main air lines for the change in air pressure as required for seasonal change. The temperature setting of the thermostat does not change when this switch takes place.

Johnson Service Co. is furnishing the temperature control.

To know, instantly, how any one of the 40 air conditioning systems is operating, a panel is installed in the engineer's office. The panel has remote reading electric resistance thermometers of the electronic type, and these will indicate the dry bulb temperature at the discharge of each air conditioning supply fan, water temperature in the main flow pipe, and the outdoor wet and dry bulb temperatures.

Insulation

All piping, equipment and ducts that transmit heat, permit heat loss or gain, or that will form condensation have been insulated. In general, steam piping, flash tanks, converters and the like are insulated with 85% carbonate of magnesia covering. Asbestos air-cell covering finished with hard plaster is used on fresh air intake ducts. Molded sectional vegetable cork covering, light duty thickness, insulates the chilled water piping.

Exterior air conditioning primary air ducts are covered with two ½-inch thicknesses of wool felt insulation and a 1/16-inch thickness of asbestos paper wired on. Other conditioned air supply ducts located in hung ceiling spaces are insulated with fiber glass board insulation. All conditioned supply and return air ducts in the pipe galleries are covered with vegetable cork. Where such ducts are concealed, they are recovered with a ¼ in. scratch coat of asbestos cement. Exposed insulated ducts are recanvased and equipment is finished with a hard plaster. Use of fiber glass, asbestos jacket over the wool felt, and the scratch coat of asbestos cement were employed to reduce the possible fire hazard.

Sponge rubber was used for the insulation of the chilled water piping connections to the window units.

Smoke and Fire Detection

A complete smoke and fire detector coded signalling system has been provided for all recirculated air chambers.

The passage of smoke of a predetermined density through any recirculated air chamber of any air conditioning system will actuate a smoke detector unit which, in turn, will actuate a smoke detector and fire detecting control board. When the control board is actuated, the following functions are performed:

(1) A coded signal will be sounded on all presignal gongs connected to the interior fire alarm signalling system to indicate the exact location of the smoke detector unit that has functioned.

(2) The coded signal will be permanently noted by recording equipment in the fire control room.

(3) At the same time that the signal is indicated, an alarm will sound continuously until silenced by a switch; the silencing of the alarm bell will light a red light which will remain lighted until the switch is restored to its normal position.

(4) Open or close contacts on the control panel to stop the operation of all fans of the air conditioning system containing the actuated smoke or fire detecting device.

The operation of any heat or fire detecting thermostat in any air conditioning return air chamber will cause the same functions to be performed as for the smoke detection.

Acknowledgments

Wallace K. Harrison was the director of planning; Max Abramovitz, deputy director of planning; James A. Dawson, chief construction engineer; Syska & Hennessy, Inc., consulting engineers.

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How Safe Is the Safety Loop?

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ONE may connect two boilers together applying every precautionary measure that he can think of for establishing proper equalization of the water levels and still find no equalization in some cases, or he may give very little thought to the matter and somehow have no difficulties whatsoever. Recently one engineer told of a steam equalizer between two boilers which was made as large as 6 inches, but still did nothing to help equalize the differing water levels of the boilers.

Of course, one may experience trouble from non-equalization of interconnected boilers where the boilers are of dissimilar size, because steaming rates will not be the same. One may certainly expect trouble with a couple of interconnected steel boilers when used for such diverse purposes as heating with one and incineration with the other, especially so if the heating boiler is irregularly fired at varying rates with a stoker. Trouble is also apt to occur with flash boilers or quick steamers which have a small water content and tend to throw water over.

Such troubles also exist where automatic water feeders are used or low water cut-offs stop the burner. These automatic devices act on the dip of wave with unclean water or lowered water level due to non-equalization. Water should be clean and true equalization attained whether or not automatic devices are employed.

With two or more interconnected boilers, hand-fired with buckwheat under natural draft, there is quite likely to be non-equalization of their levels due to the many variables such operation may set up. Each boiler will be fired at different times at differing time intervals with varying charge and thickness of fuel bed, all because of hand firing. A thin fuel bed is required because the available draft is quickly used up by too much depth of buckwheat coal. Bare spots and excess air are a consequence of thin fuel beds, and these will vary according to the distance of each boiler from the stack.

Any boiler with a revertible flue (that is, with a final flue or passage to the bottom of the boiler at its rear) may collect cold air in the flue during off boiler periods. This affects the oil burner when it first comes on, and, since it is more difficult for the chimney draft to pull through such downward devices, the draft may favor the down flue of one boiler over that of the other. Even where two such boilers are piped for equalization and their oil burner nozzles calibrated for equal rate of flow, there may still be difficulties upon occasion with differing water levels.

Sometimes the check valve on a pump discharge will slowly leak backward while the pump is stopped. Float regulation will then cause frequent starting of the pump, usually a sure indication of such leakage, and, of course, this makes a lowered water level within the boiler.

Check valves have long been used to prevent water from backing out of a boiler even though they hold up water in the wet return of a gravity system, sometimes to a troublesome height. Those with light aluminum vertically-hung flaps give least resistance and therefore hold up less water. Check valves, however, do not always have the same resistance, even when new, and much less so when dirty or worn. The result is that they seldom work in unison and sometimes stick open or shut, or partially so. Once a check opens it is likely to ship all the water present at the time to flood one boiler; this flood is prevented from eventual flow back to the other boiler of lower water level by the check valve on the first boiler.

The so-called Hartford, Underwriters' or safety loop is preferable to use of check valves at boilers, but some engineers like neither safety loops nor check valves. A loop on a single boiler with a pump set close to the boiler reduces the chances of a break, leak, or corrosion between the pump and boiler, but with

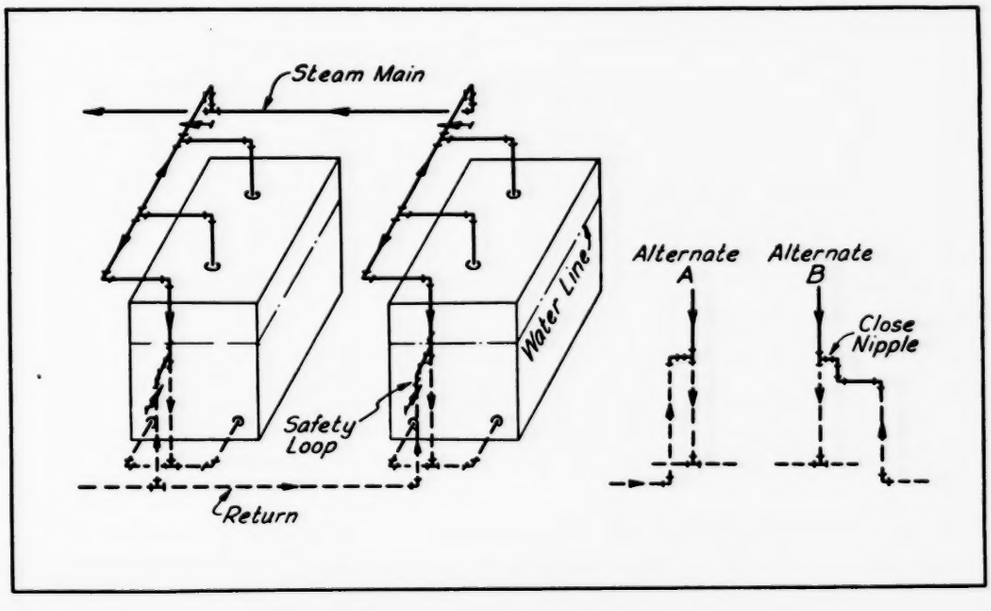

Fig. 1. Safety loops with partial equalization.

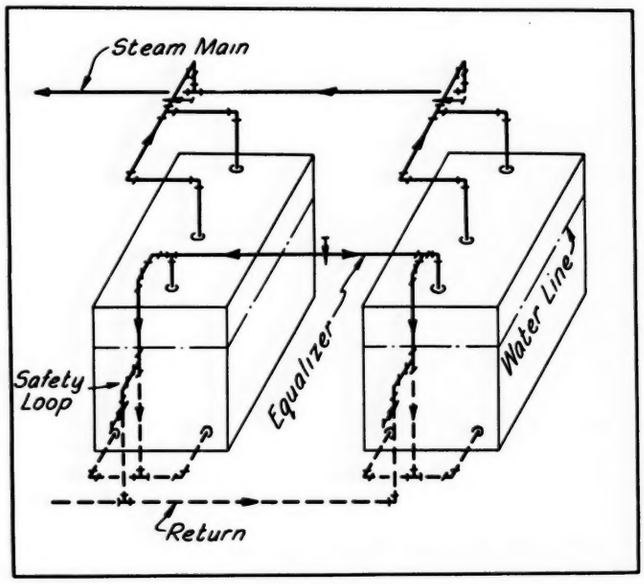

Fig. 2. Safety loops with full and true equalization.

two boilers the loop is required for an additional purpose—that of equalization of water levels between the two boilers.

Stop valves on boilers are liable to cause trouble by being operated improperly, especially where the wet returns can flood backward. They are shown in the sketches to illustrate the points to be made. Closing of a steam valve on a steaming boiler before its return valve is closed will back water out of the boiler into the main return line if the piping is arranged as shown in Fig. 4, but this cannot happen where there is a safety loop, as in Fig. 1 to 3. In Fig. 3, however, the sequence of valve operation as described would back water out of one boiler into the other, yet a safety loop common to both boilers is often used as shown.

An equalizer line should never be valved, but if for some reason separate operation of the boilers may at times be desired, then valving is required as shown in Fig. 2 and 4. Even then the use of this valve can be avoided provided that the equalizer is connected to the steam leads in the same manner as the return equalizer is connected to the return leads. A disadvantage of connecting to the steam leads is the drop in boiler pressure up to the point of their take-off from the steam leads caused by the friction of the steam. True equalization requires direct connection from tapping to tapping of each boiler, as in Fig. 2 and 4.

There appears to be a real need for stop valves at low pressure boilers. They are a help, of course, in making hydrostatic tests on a boiler where this is required, or where it is desirable that pressure be raised to flush out a boiler. However, tests can be made by temporarily blanking off a boiler, and flushing out should be done only throughout the entire system to force all dirt to the boiler. If this is not done the dirt will be circulated back gradually over a period of time and thus make necessary more frequent cleanings. Some water treatments do not even require a flushing out.

Valves do enable shutting off of a system to free it from steam, should this be ever desired. Here, again, there is a way around, for the same thing can be accomplished, at least for a time, by covering the fire with soft coal ashes, preferably damp. Opening the firing door and stack damper will soon cool off a boiler to stop steaming, or steam can quickly be liberated from a boiler and system by opening the safety valve.

Because safety loops may introduce certain complications, preferred and true equalization seems to be obtainable only as shown in Fig. 4. Here there is equalization over the top of the water and equalization again at the bottom of the water. The equalizers should be of ample size, short and direct, and connected to boilers at safety valve and boiler return tappings. In the case of steel boilers, the direct and separate steam equalizer connection may require a second steam outlet, but this can be obtained with the boiler upon order.

The importance of direct connections may be better appreciated when one reflects that water levels in the several sections of a cast iron boiler are not uniform, even though these sections are connected top and bottom with large nipple ports. Some sections will be more active in circulation and evaporation, most likely those receiving radiant energy from the fire, or where most of the hot gases pass by, or where the most heating surface lies, as in a rear section. Inequalities of water levels between sections are no doubt the explanation for many of the mystifying cases where the water levels of two boilers do not equalize, even though apparently well piped for that purpose.

Obviously, the idea back of the safety loop is to give the same equalizing effect as would be obtained in an added boiler section. The loop is connected to the steam space and to the water space at its lowest part, the same as in each boiler section, hence the importance of using large pipes to form the loop.

With the safety loop any fluctuation of water level caused by the boiler or by intermittent pump discharge tends to trap steam momentarily, condense it, and cause pounding in the horizontal connection of the

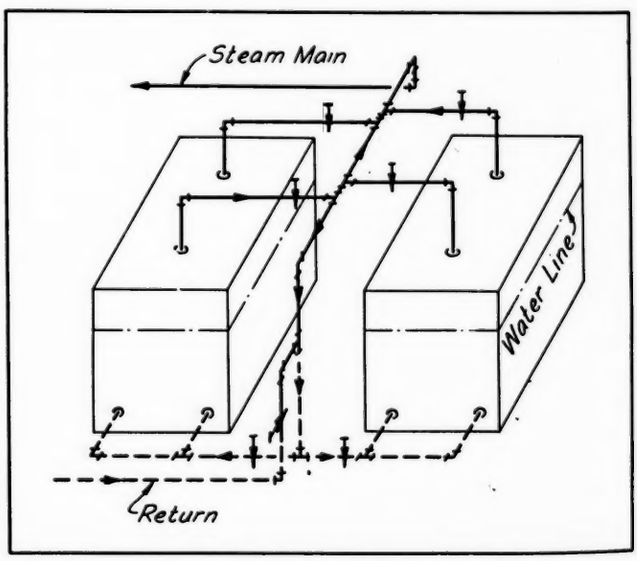

Fig. 3. Safety loop without separate protection of each boiler.

loop near the dancing boiler water line. For this reason, a close nipple is required in the horizontal as shown at *A*, Fig. 1, or *B* in the same drawing if the return rise must be some distance away for physical reasons.

The difficulty with this arrangement is that water can leave the boiler down to the inside of the horizontal pipe connection. If this pipe is sizable and well immersed below the boiler water line, the low water situation might become a hazard, particularly so where the steamfitter carelessly installs the connection even lower than required, as often happens.

To overcome such conditions, the writer has for years advocated the wye connection with the inverted inside apex of the wye at the boiler water line. Such a connection maintains a higher boiler water line, eliminates all steam pockets and gives but little area for steam and water contact. This fitting is not a complete cure-all when used with a pump as it has a tendency to inject and therefore pound on cold water pump discharge so that it, too, should be immersed, though not to the same extent as with the horizontal connection.

Safety loops give more trouble with pumped returns than with gravity returns. For best results with pumped returns, all parts of the loop should be of the same size and not less than return pipe size. For example, trouble will ensue with a 2-inch equalizer connected to a 4-inch return loop. Trouble will also follow where a pump with a 1½-inch discharge outlet is piped 1 inch to the loop to give a high velocity stream of cold water pumped up and down in the loop to bang badly on start-up when the entire system is cold.

A pump with 20 lb discharge against 0 to 2 lb steam pressure on the boiler will give considerable injection into the boiler with condensate of 70 to 80F suddenly mixed into water of 212F or more. Such a discharge is bound to make noise, especially so where the pump is over capacity and its float set for too much discharge at a time. A pump, of course, returns the condensate at periodic intervals as its receiver fills up, hence it can create difficulties at the boiler. Such intermittent return may be particularly troublesome with the very cold returns which prevail at the start of a heating period, and, where this occurs in buildings which are intermittently heated, the results are most troublesome. Buildings heated in this manner include churches, auditoriums, moving picture houses and township schools. These are all jobs which perhaps could be well served by the simple condensation pump instead of a vacuum heating pump.

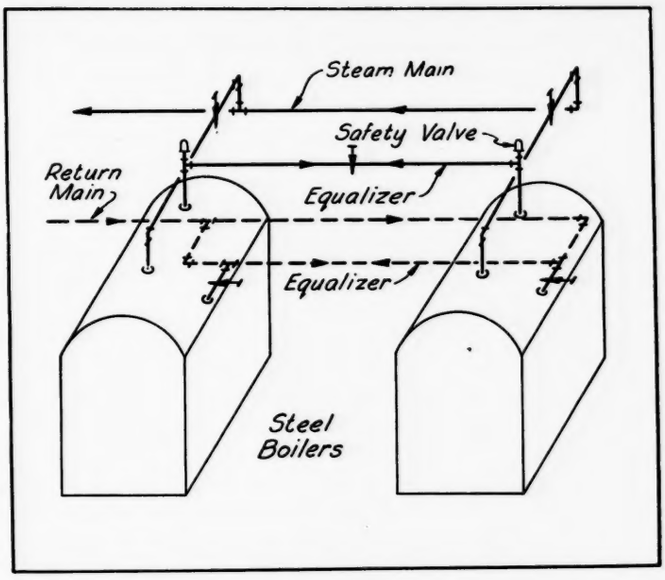

Fig. 4. True equalization without safety loops.

Buildings of the kind mentioned are not occupied after their function is served by the end of the day. Heat is then shut off and, as a rule, not turned on again for eight or ten hours unless the weather is very severe. During that interim the outdoor temperature could drop well below 50F, and, as a consequence, all condensate out in the system could be well cooled or chilled. When steam is finally turned on again, the boilers will have to operate at peak load with maximum furnace temperature and with pumps normally operating four or five times before the return water is warmed up. The result of all this is pounding or hammering in the pump discharge return for about a half-hour before normal action is reached.

The simplest way to remedy this condition is to connect the pump discharge into the return header or a low tapping of the boiler shell and dispense with the safety loop. Of course one could do this and still retain the loop, provided each connection was valved and operated at its appropriate time. Such an alternative would probably not be acceptable to insurance interests since it would be possible to operate all of the time without the loop, or to have a condition where both valves were closed; in fact, use of such an arrangement would probably be objectionable for even part time.

Plastic Pellets Suppress Acid Spray

For the suppression of acid spray in plating and stripping tanks, small pellets of Bakelite polyethylene are floated on the surface of the liquid in large enough quantities to completely cover over the open area. These pellets will always float since polyethylene has a very low specific gravity. The pellets also act as a heat insulator in cold weather to prevent radiation losses in the tank which would affect the plating results. The suppression of the spray saves the ventilating system from being replaced frequently as well as prevents the operators from inhaling the fumes. The pellets are so designed that work may be easily removed from the bath, for the pellets realign themselves and cover over the exposed chromic acid of their own accord. In conjunction with sulphuric acid stripping baths, the pellets prevent the dilution of the acid by deliquescence from moisture in the air. Since the plastic material will not absorb water and is unaffected by strong chemicals, they will continue to float through long periods of operation and will not plug up drains.

The Heat Pump: Something for Nothing?

F. W. HUTCHINSON*

The relationship of the availability of energy to its unit cost sets the heat pump in its logical place as an energy mining mechanism. Readers are reminded that the heat pump is a specialized heater, not a heating system.

A POUND of coal buried in the depths of the earth contains just as much heat as a pound of coal in a fuel bin, but the unmined coal is unavailable, whereas the fuel in the bin possesses immediate usefulness. Few people consider, however, that in purchasing coal the price they pay is almost entirely for availability rather than for heat. If a homeowner were offered a limitless supply of fuel—but located at the north pole—he would hesitate before purchasing—irrespective of how low the price might be—because he would think in terms of the cost of transporting the fuel and making it available for use in his basement; free coal at the north pole would doubtless be more expensive than purchased coal at the neighborhood fuel yard. Thus it is evident that the consumer should evaluate the cost of heat not merely in terms of the number of British thermal units offered him, but also in terms of availability and immediate usefulness of those Btu.

In discussions of and advertisements for the heat pump the statement has frequently been made that, in place of using fuel, it utilizes "free" heat taken from the earth, the air, or some adjacent body of water. Such a statement is true in the same sense that coal would be "free" if given away unmined at the north pole; although the coal was "free" the cost of digging it from the earth and transporting it to the place of use would probably make it prohibitively expensive for use as a source of energy for space heating. In exactly the same way the cost of thermally digging "free" heat from the earth (or air, or water) and of transporting it to the place of use will in many cases make such energy prohibitively expensive. A heat pump is, in effect, a thermal shovel for digging heat from a low-temperature "mine" and delivering at a sufficiently higher temperature level to permit its effective use in space heating. Since the temperature of earth, air, and water is low during the winter months and since energy—for use in comfort heating—must be available at a temperature considerably higher than 70F, it follows that the "free" heat must first be extracted from the medium which contains it (just as the coal must first be extracted from the surrounding rock) and then lifted from the low-temperature level to the required higher-temperature level.

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In the field of energy, as in that of labor, the cost of one unit of work varies with the skill of the worker. One energy unit stored in water at 50F is inexpensive because it exists in a natural state like coal in the mine and its ability to do work is negligible; whereas one unit of electrical energy is costly because a great deal of equipment and effort has gone into making it available—a worthwhile expenditure because the electrical energy can be utilized for any type of working purpose. Most heat pumps are driven by electric motors, hence utilize the most expensive (on a unit basis) form of energy; the heat pump uses the most highly skilled of all varieties of "thermal" labor. Thus it is not surprising that the delivered cost of energy pumped by such a unit is, in most localities, greater than the cost of energy from fuel even though — to quote the advertisements—the heat pump extracts "free" energy from its source.

Even more important than the misrepresentation implicit in the claim of "free" heat is the common misconception of a heat pump as a complete heating system. All heating systems are made up of four basic processes:

(1) Transformation of energy, as from the chemical energy stored in a fuel to the heat energy released in a furnace.
(2) Transportation of energy from the place of transformation to the point of use, as by steam or water pipes, or by air ducts.
(3) Liberation of energy to the heated space, as from convectors, radiators, heating panels, or warm-air grilles.
(4) Distribution of energy uniformly through the heated space by careful sizing and location of the energy liberating units.

Each of these four processes is equally important in determining the satisfaction to be realized from a heating system and failure or ineffectiveness in any one of the processes will as surely destroy the effectiveness of the system as would failure of any one link in a chain. Thus the architect, the homeowner, and the engineer must constantly check all rather than just one of these four basic requirements.

In a correct technical sense a heat pump is in no measure a heating system, but rather is one method of carrying out the first of the four major processes. Thus a furnace serves to transform chemical energy stored in coal, oil, gas, or wood into available heat energy, and in exactly the same way a heat pump serves to transform thermal energy stored in the earth, the air, or in some other source into available heat energy. Specifically, therefore, a heat pump is a device which

replaces a furnace as one element of a heating system and *it is no more than this.* Unfortunately this vital fact has become obscured due to the fact that many of those who market heat pumps do so as part of a completely packaged heating unit which is designed to serve all four processes. This may, of course, be a desirable and an effective system, but the prospective purchaser should bear in mind that in selecting such a unit he is committing himself to three arbitrarily imposed conditions that do not basically relate to the heat pump as such.

In either selecting or designing a heating system, it will usually be most advantageous to start by making four separate decisions, each with respect to the particular structure to be heated and with respect to local factors such as climate and cost of various types of energy. These decisions correspond to the four major processes and are as follows:

(1) Do I wish to use coal, oil, or natural gas as a fuel, or is electricity preferable, or is a heat pump practicable?

(2) Do I wish to use hot water, steam, or warm air in transporting heat to the place of use?

(3) Do I wish to use convectors, radiators, grilles, or heating panels as the method of liberating heat within the occupied space?

(4) In terms of the decision in number 3, above, what method of distribution is to be used?

Having made these four separate decisions, the next step is to investigate the possibility of combining the four selected processes into an efficient and economical heating system. In many cases the decisions may be incompatible and when this is true there will obviously be need for compromise. Thus, selection of air as the medium for transportation of energy necessarily requires use of grilles rather than any other type of heat distributing unit. Similarly, selection of a heat pump as an energy source will in many cases prevent use either of the selected method of transportation or of the selected type of heating unit for location within the room. Limitations in operating range of the heat pump often make it unsuitable for use with the other elements of conventional heating systems, hence selection of a heat pump may commit the owner to an entire system which differs in three out of four respects from the kind that he would most prefer. In some cases the decision can still be justified, but the point of importance is that the heat pump itself is only one element of the system and if complete satisfaction is to be achieved *all four* elements must perform with equal effectiveness.

Summarizing, the extensive popular interest which has been shown in the heat pump during recent years is due in part to a widespread but mistaken belief that it permits the use of "free" energy in place of the fuel used in ordinary systems. Undoubtedly this fallacy arises from the very human desire to "get something for nothing" and, as is always true in such cases, it leads inevitably to disappointment. The energy which flows through a heat pump is in fact free, but it is free because of the fact that in its existing state it is completely unavailable and hence entirely useless. The heat pump extracts this useless energy and reconditions it to a higher temperature level at which it may be effectively utilized, but the cost of extraction and of reconditioning is as directly chargeable to the energy as is the cost of mining and transportation chargeable to the man who purchases a conventional fuel.

The second popular misconception concerning heat pumps is that they are heating systems rather than—as is the true case—units which merely replace the furnace of a conventional heating system. A heat pump, like a fuel-burning furnace, releases energy which must then be transported to its place of use, released within the space to be heated, and distributed through that space in such a way that the occupants will realize uniform heating effect. Thus a heat pump takes the place of only one of the four parts of a conventional heating system; in order for its use to be effective it must be integrated with the three other parts to constitute a complete system.

50% R. H. Kills Germs

Experiments by the Departments of Medicine and Biochemistry at the University of Chicago proved that a relative humidity of 45-55% at about 72F was almost immediately fatal to certain types of air-borne bacteria suspended in saliva droplets. It was also shown that these same bacteria were virtually unaffected at either low, or high relative humidities.

These facts were established by tests made with bacteria laden droplets suspended in air. The droplets were composed of human saliva having a normal salt content. At intermediate relative humidities (45-55%) a chemical environment was achieved in the droplet whereby the toxic action of the salt concentration immediately killed the bacteria. At low relative humidities, dehydration takes place and apparently cell respiration is suspended so that the bacterial cell is not affected by the high concentration of the salt which remains. At high relative humidities, the water present so diluted the salt that the cell was again unaffected.

The three types of bacteria used in this research showed relative survival rates at intermediate relative humidities in the order named, beginning with the germ killed most quickly: Pneumococcus, Type I, the germ that causes pneumonia, staphylococcus albus and streptococcus hemolyticus, group C. Although only three types of bacteria were tested, the way was pointed toward further research on the effects of relative humidity on the thousands of aerial microorganisms that daily cause infection and death among mankind. It was demonstrated, however, that maintaining a relative humidity of 45-55% can assist in reducing human infection from air-borne bacteria, and aid human health by helping prevent respiratory diseases. The experiment also suggested a possible explanation of the seasonal variation of many diseases caused by free-floating germs.

Pressure Ventilation of Passenger Transport

M. E. HANSON

Formerly with Sturtevant Division, Westinghouse Electric Corp.

A method of supplying air to cars and buses with reasonable control of source and amount.

SIMPLE ventilation of railroad cars, trolley cars, and buses, where mechanical cooling is not provided, must remove excess heat and air contaminants and must supply outside air for breathing.

There are three ways to accomplish these purposes with varying success. Simplest is to open or close windows or other openings manually and rely on natural air currents. A second method is to exhaust inside air mechanically and allow replacement air to enter through such openings as are provided. The third method is to blow air mechanically into the car and exhaust through car openings.

The manual opening of ports for natural ventilation has obvious limitations with which everyone is familiar.

Where ventilation is accomplished by exhaust fans, supply air ordinarily enters the car through doors, windows, and any other openings which are not sealed. The result is usually poor distribution of the supply air and poor control of air movement inside the car.

Pressure ventilation, that is the supply of outside air into the car through fans, has several advantages. The amount of outside air supplied can be regulated according to the temperature inside the car. Air supply fans can be provided with diffuser outlets for adequate mixing of air. Supply air can be introduced from the roof where contamination by dust and odors is less severe. Drafts and by-passing of outside air are avoided.

A system of passenger transport ventilation has been devised which consists of a fan recessed flush with the car ceiling and enclosed either above a lowered car headlining or within a built-up monitor on the car roof as in Fig. 1. A shroud ring around the fan blade tips is shaped like a flattened venturi with the fan wheel revolving in the throat as in Fig. 2. Fan wheel is mounted directly on the shaft of the hub-mounted motor. An 0.45 hp, 150-volt d-c fan designed for the arrangements described moves from 3,000 to 3,500 cfm at a top speed of about 860 rpm. A diffuser outlet is provided, and air is supplied to the fan through a thermostatically controlled system of louvers so that outside air supply can be controlled from zero to 100%.

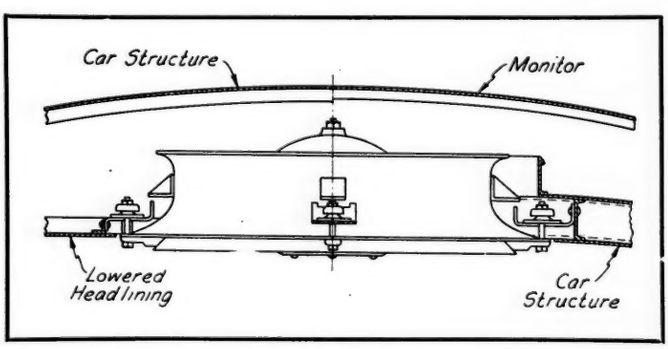


Fig. 1. Two methods of mounting fan. Right section shows mounting in car roof with built up monitor for intake. Left section shows mounting below roof with ceiling lowered to form intake plenum.

In warm weather, speed of fan is automatically increased as is the proportion of outside air. In cold weather, most of the air handled by the fan is recirculated with only enough outside air introduced to handle the breathing load (5 to 10 cfm per passenger) while the speed of the fan is reduced.

Thus, in the summer the diffuser outlet provides a comfortable rate of air movement over occupied areas to augment evaporation from perspiring passengers.

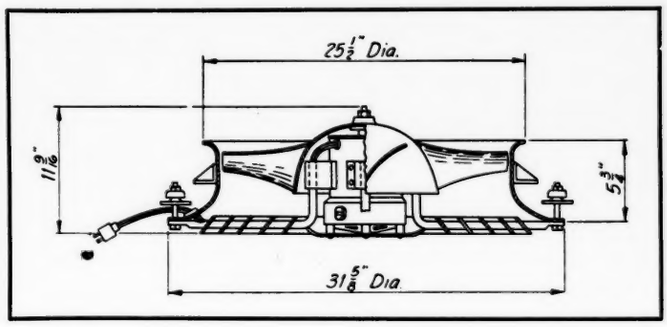
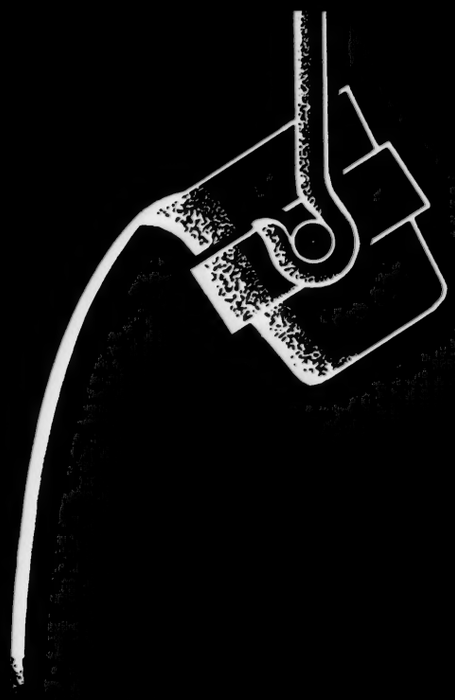


Fig. 2. Sectional view of fan.

In cold weather air movement is reduced but is maintained at a level consistent with breathing requirements.

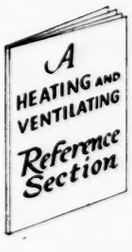
A minimum of five air changes per minute on an empty car basis has been found to give good results at maximum fan speed for usual passenger loads. Thermostats are arranged through a series of electrical resistances to control the speed of fans. These controls are designed to stop the fans or nearly stop them at a low temperature, say about 55F, in the car body and to develop full speed at 80 to 85F. Similarly, outside air inlets are arranged to be fully open at the highest speed of the fan and fully closed at the lowest speed. When the fans are spaced 8 to 10 feet apart, distribution of air within the car will be even and adequate for full evaporative effect in warm weather.

An adaptation of the system relies entirely on the ordinary car openings such as windows and doors for supply air, while the fan is suspended from the ceiling and merely recirculates the air within the car. For the latter arrangement, a grilled inlet is provided above the fan blades and surrounding the fan motor, while the fan outlet is provided with a diffuser as before.



FOUNDRY CUPOLA DUST COLLECTION

WILLIAM N. WITHERIDGE
Ventilation Consultant, Research Laboratories Division,
General Motors Corporation



Foundry Cupola Dust Collection

WILLIAM N. WITHERIDGE
Ventilation Consultant, Research Laboratories Division, General Motors Corporation.

A review[1] of methods for the removal of dust from cupola stack gases and a discussion of the properties of emissions from the ferrous foundry cupola.

Part I – Ferrous Cupola Emissions

THE cupola is a vertical cylinder "wind-furnace" for the melting of metal and the liquefaction of wastes for convenient removal. It requires on the order of 1 to 1½ tons of air for every ton of iron melted and the gases leaving the cupola carry with them from 10 to 50 lb of dust for every ton of metal produced.

The cupola furnace may be known as "cold-blast," "hot-blast," or "dry-blast." Its air supply can be automatically regulated by pneumatic or electric systems to give a constant airflow weight or volume; or the amount of air can be automatically varied in rate by an electrical interlock with combustion gas analyzers measuring either carbon dioxide or carbon monoxide to give a constant stage of combustion. Air is considered just as much a part of the charge as coke and metal and fluxing materials. In truth, air conditioning has invaded the wind-box or bustle-pipe of the cupola.

In certain respects the coal furnace and the foundry cupola seem to be approaching one another. The new cyclone coal burners operating above the ash fusion temperature, or near 3,000F, dispose of most of the coal ash in the form of molten slag, flowing slowly out of the furnace. At the same time, the cupola operator is feeling the force of an accelerated program of air pollution control, and is looking around for new ideas in flue dust or fly ash suppression.

In various forms this type of metallurgical furnace has been in use for many centuries. "In olden times the top of a blast furnace was 'by day a pillar of cloud . . . by night a pillar of fire', for no attempt was made to collect the gas." (1)[2] About 100 years ago the two processes of iron ore reduction and iron melting for the foundry began their gradual divergence toward specialized forms, and now they are hardly recognized as the same kind of industrial equipment. Even so, the foundry cupola may still be considered a small brother to the modern blast furnace.

The following pertinent observation was made over thirty years ago:

"In congested districts it is customary to top the cupola with a spark arrester or hood provided with iron netting to catch sparks and glowing coke pieces. The dilapidated appearance of these hoods after a time shows how desirable it is to avoid putting them on at all. If the cupola is carried high enough to overtop the surrounding buildings by at least 10 ft, there will be little trouble encountered unless the melting practice is exceptionally bad and excessive fuel has to be used. Then the flame will belch from even high cupolas, sparks and glowing cinders will fly around and endanger property, cause suits at law and embitter the residents against the foundry in question." (2)

Perhaps in passing the half-century mark we may enter a period of industrial architecture that not only avoids the "dilapidated appearance" of crude spark arresters, but even capitalizes on the opportunity to soften the severity of box-like structures by careful treatment of streamlined geometry for the foundry cupola—complete with smoke and dust abatement accessories.

The properly operated cupola has been called the most efficient of all melting furnaces, because the fuel is in direct contact with the charge. However, it would be a mistake to overstress the desirability of attaining ever higher fuel combustion efficiency. Extending beyond the single purpose goal of highest possible combustion efficiency in the burning of fuel for heat and power generation, the operation of a cupola has the two-fold objective of economy and metallurgical control.

"Maximum economy is not attained with maximum efficiency of combustion, since the saving in coke will not counterbalance the cost of the elements lost" (such as silicon and manganese). (3)

In addition to the melting process, there is also an important reducing-oxidizing equilibrium between carbon monoxide and dioxide, producing a "heat-treating" atmosphere. So far as oxygen is concerned, the process is adjusted to consume most or all of it as rapidly as possible before the gases reach the melting zone, in order to avoid an excessive oxidation loss of iron, silicon, and manganese. If the brown smoke of oxidized metal passes out of the stack, it suggests a waste of valuable materials.

Properties of Solid Emissions

An effective attack upon a problem of air or gas cleaning is based upon some knowledge of the constituents of the contaminated gas. When this information is lacking, a project of stack gas sampling is in order. Before approaching the job of sampling and analysis

[1]Prepared for publication in HEATING AND VENTILATING, in "Foundry," and for presentation at the Regional Conference of the American Foundrymen's Society, East Lansing, Michigan, October 28, 1949.

[2]Numbers in parentheses indicate references listed at the end of this article.

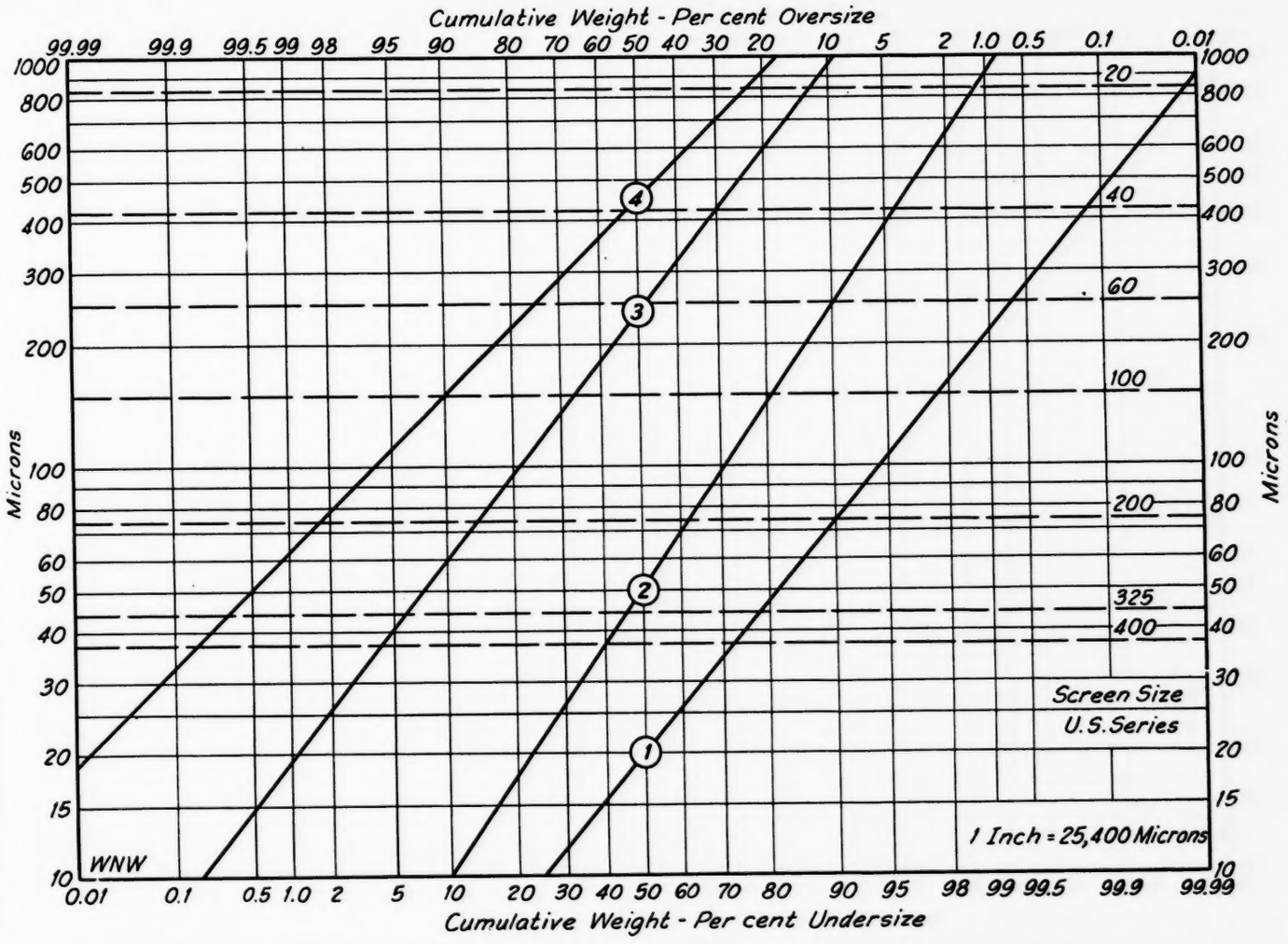


Fig. 1. Relative size distribution of several dusts on logarithmic-probability coordinates: (1) Representative distribution of many pulverized coal fly ash samples; (2) Distribution of a few cupola flue dust samples; (3) Insoluble portion of solids collected by a wet dust arrester; (4) Single dust sample settled on foundry roof near cupola stack.

it is well to know the nature of the process causing the contaminants.

The solid matter in ferrous cupola stack gas is heterogeneous both in size and composition. In size it ranges chiefly from 1 to 1,000 microns; in specific gravity from 1.5 to 7.5. It is partially magnetic, corrosive, and abrasive, and contains coke, ash, compounds of sulfur, and oxides of silicon, aluminum, calcium, magnesium, manganese, iron, zinc, lead, and possibly other elements getting in with the charge.

In Fig. 1 is a series of four lines representing samples of dusts from several sources. Their relative geometric mean sizes can be judged by their vertical positions along the 50% size line. Thus, the entire range of solids from the few cupolas represented by curve 2 is shown to be somewhat coarser than the range of dust sizes produced by the burning of pulverized coal.

Actual analyses of dust samples seldom produce truly straight lines on these coordinates. Nevertheless, a representation of this kind is far more significant than specification of a single figure for average particle size. The counterpart of a straight-line logarithmic-probability plot can be expressed in a number of ways:

(b) 50% through X-mesh screen, 90% through Y-mesh

(c) 50% size X, standard deviation S

(d) 10-50-90 cumulative per cent undersizes: X-Y-Z*

Particle size, shape, specific surface, and specific gravity (the 4 S's) are all integrated into one value when direct measurements are made of the "terminal velocity" distribution of a dust sample by elutriation or sedimentation. However, cupola flue dusts have not been studied by either of these procedures to a degree that will permit a discussion of terminal velocities, and thus it is better at this time to refer to screen and subscreen ratings in size groups on the micron scale. Fig. 1 has been arranged, therefore, on the universal micron scale, rather than either terminal velocity or screen mesh sizes.

The particulate matter near and below 1 micron is chiefly responsible for the optical density of combustion effluents. While some of the submicron and even submicroscopic particles will be removed in the course of gas washing, most communities are not so much

*Note that this method can describe a plot with a slope in the

concerned with this fraction of the solid matter for the present. There is a good deal of control necessary for particulate matter above 5 or 10 microns before we can expect large-scale application of equipment that is truly effective below this order of size. This position is reasonable, since the effluent from the gas cleaning equipment is discharged out-of-doors.

Carbonaceous smoke that might emerge from the cupola should be prevented at its source, which is far more practicable than efforts to remove submicron particles from the gas by cleaning. Incomplete combustion of oily or tarry substances getting into the cupola charge will cause such smoke, as also will the burning of wood during the light-up period. A pilot gas burner opposite and slightly above the open charging door serves as an igniter and helps to keep the gas burning, especially desirable in the event of a smoke nuisance due to oily scrap in the charge. Since the fuel charge is coke or charcoal, it contributes only slightly to any visible emissions.

TABLE 1—CUPOLA SIZES AND NOMINAL MELTING RATES

Iron-to-Coke Ratio[1], 10:1

Air Blast-to-Coke Ratio, 8:1

Cupola Size Number	Shell Diameter, Inches	Diameter Inside Lining[2], Inches	Inside Cross-Section Area[2], Square Feet	Nominal Melting Rate, Tons/Hr	Iron Melted, lb/(hr)(sq ft)	Air Blast, lb/(hr)(sq ft)
0	27	18	1.8	1¼	1390	1110
1	32	23	2.9	2	1380	1100
2	36	27	4.0	2¾	1380	1100
3	46	32	5.5	4	1450	1160
3½	51	37	7.5	5¼	1400	1120
4	56	42	9.6	7	1460	1170
5	63	45	11.0	8	1450	1160
6	66	48	12.6	9	1430	1140
7	72	54	15.9	11½	1450	1160
8	78	60	19.6	14	1430	1140
9	84	66	23.8	17	1430	1140
9½	90	72	28.3	20¼	1430	1140
11	102	78	33.2	23¾	1430	1140
12	108	84	38.5	27¾	1440	1150

[1]For other coke ratios, assume nominal coke charge of 150 lb per hr per sq ft of cross-section area inside the lining at the melting zone. Range is about 100-200 lb per (hr) (sq ft).
[2]Straight shaft cupola assumed for convenience.
Adapted from Table 2, pp. 20-21 and Table 6, pp. 100-101 AFS Handbook of Cupola Operation (1946).

As continually stated in the field of coal smoke abatement, the remedy is not the installation of elaborate cleaning devices capable of removing particulate matter less than 1 micron in size, but rather the thoughtful attention to the burning process itself with a view to making it more complete.

It is generally agreed among smoke abatement authorities that the Ringelmann scale of apparent smoke density has only slight connection with the weight of materials discharged from a combustion stack. Some years ago Marks (4) drew attention to the difficulties in applying the several visual methods of estimating smoke density. Nevertheless, as an optical rating easy to comprehend, the Ringelmann scale does bear some relation to community attitude toward a given stack, and accordingly its use persists in smoke abatement and air pollution regulations.

Quantity of Cupola Emissions

The quantity of dust passing up the stack can be related to the quantity of iron melting, and it apparently varies from 10 to 50 lb per ton of iron, according to the data available at this time. Translated into grains per cubic foot of discharged gas, this represents a dust concentration of about:

3 to 15 gr per cu ft with a closed charging door;

0.2 to 10 gr per cu ft with an open charging door.

Until further detailed investigations have been reported, the quantity of materials discharged by the cupola is estimated to be on the order of the following relationships:

$1{,}500 \pm 500$	pounds of combustion gas leaving the melting zone per hour per square foot of internal cross-section area of the cupola (slightly more than blast air weight)
$6{,}000 \pm 4{,}000$	pounds of combined gas and air discharged from the cupola stack per hour per square foot, with the conventional open charging door
15 ± 10	pounds of gas-borne solids emitted from the stack per hour per square foot
1.5 ± 1	pounds of solid and gaseous sulfur discharged per hour per square foot, assuming maximum 1% sulfur in the coke

By stating the above relationships on the basis of mass velocities, or pounds of solids per hour per square foot, the air and gas temperature and pressure variables are eliminated. From the cupola size data in Table 1, estimates can be made of the total mass flow rates in pounds per hour. Conversion from weight to volume rates of flow at atmospheric pressure is readily made by the approximate equations:

$$\text{AIR:} \quad \text{cfm} = 25 \left(\frac{t + 460}{1{,}000} \right) \text{lbm}$$

$$\text{GAS:} \quad \text{cfm} = 24 \left(\frac{t + 460}{1{,}000} \right) \text{lbm}$$

where: cfm = cubic feet per minute
lbm = pounds per minute
t = temperature in degrees F, ranging generally from 600F to 1,600F for untreated and undiluted stack gas

The great variation in the quantities of stack gas emerging from the cupola is due to intentional as well

as unintentional differences in its use. These differences are found in the efficiency of melting, degree of control over air weight delivered, whether the charging door is left open continuously, backdraft at the top of the cupola caused by a dust collecting device, height of stack, heat value of coke, whether cold or hot blast, dry or humid, and numerous other factors of design and construction.

Kling (5) reported that the dust loading of blast furnace gas at 60F and 30 inches of mercury is approximately in proportion to the gas velocity, in the ratio of grains per cubic foot = 0.29 gas velocity in feet per second. Thus, at a gas velocity of 20 fps, or 1,200 fpm, the loading on this basis would be 5.8 gr per cu ft. The directness of this ratio probably is due to the predominant effect of the large particles in the gas stream. At 20 fps, a 5,000-micron, irregular-shape, porous, coke particle would be carried upward, and at the same velocity a 1,000-micron particle of iron would be lifted out of the stack. (Note that in the case of a blast furnace, the combustion gas is not diluted with air entering the stack.)

Although these facts are of interest as an indication of the results we may expect from extended study of the cupola, it is well to remember that the physical as well as chemical properties of materials going into the blast furnace are considerably different from the nature of the cupola charge. It is proper, therefore, to view any data on blast furnace operation with a good measure of reserve when speculating on the nature of emissions from the cupola.

Coke is a brittle material, and rough handling while charging will produce an excessive amount of fine particles in the class of coke breeze. Dropping light-weight coke particles into the rising gas stream transfers them promptly to the atmosphere or the gas cleaning equipment. It is well to remember that a charging bucket aggravates the carryout of fine particles at the moment of dumping because of the reduction it causes in the cross-section area available to the combustion gas. The gas is momentarily accelerated in passing around the bucket, and its ability to transport dust is correspondingly increased.

Likewise, the addition of scrap metal in the form of fine chips not densely briquetted will allow the gas stream to lift some of this metal out of the stack before it has reached the fusion temperature near the melting zone. Excessive sand carried on the scrap iron returned from the casting department also will aggravate the dust carryout in the stack gas.

Combustion Gas Dilution

One of the factors that should not be overlooked in the design of cupola dust collection systems is the dilution experienced by the combustion gases as they rise up past an open charging door and mix with the air induced at that point. Whether this effect is an advantage or a disadvantage depends on the destination of the combined stack gases, and the attitude toward them from an air pollution viewpoint.

The advantages of diluting the combustion gas with induced air include: a cooling effect (which may be offset by the heat of combustion in case the temperature and CO content are high enough); a lower concentration of both gaseous and solid matter; a fresh supply of oxygen to burn the carbon monoxide in the waste gas and possibly any carbonaceous smoke reaching this point; and a ventilation effect on the charging floor due to the removal of air through the charging door.

The disadvantages of combustion gas dilution appear essentially under the same categories, but from an opposite viewpoint. If recovery of a part of the heat content is desired, cooling the gas with air will reduce the amount of sensible heat that can be recovered. Cooling also will make it more difficult to recover the latent or potential heat in the carbon monoxide by its combustion, which requires both a sufficient concentration (13% or more in air) and a high enough temperature for ignition (1,000F or more).

Excessive cooling of the combustion gas also reduces thermal updraft, with the possible danger that carbon monoxide will come out of the charging opening into the breathing zone of workmen at that level, especially so with a large charging door.

Dilution of the finer particulate gas contaminants makes them more difficult to remove, and requires larger capacity gas cleaning equipment. Although dilution (not resulting in combustion of carbon monoxide) implies a certain amount of deceleration of the gas velocity by cooling when only natural draft forces are available, it may not be as effective in permitting the heavier particulate matter to settle as moderate expansion of the initial gas stream without dilution.

Furthermore, dilution of contaminants does not reduce their mass emission rate, or the number of pounds emitted per hour. Air pollution control authorities are becoming more concerned about the total quantities of contaminants discharged into community atmospheres, and are considering changes in their regulations to give better control over this index of pollution. So far as power plant flue dust is concerned, the dilution factor has been under control for some time by requiring that stack gas analyses be adjusted to a condition of not over 50% excess air, or to a carbon dioxide concentration of around 12%.

With the above considerations in mind, it is best to know the amount of dilution of combustion gas with normal air before attempting to correlate the quantities of contaminants issuing from the cupola with the weights of metal charged or melted. This requires only that both the blast air and the gas emission weights be stated, since the combustion gas weight is only slightly more than the blast air weight. It is better, however, to estimate the airflow into the charging door as well, and thereby establish a more certain control over the reliability of the data. (See Appendix.)

Allowable Emission Rates

At least in one community—Los Angeles County—the opportunity to meet air pollution regulations by the simple expedient of diluting stack gases with air came to an abrupt halt with the passage of new regulations effective April 5, 1949. These regulations not only specify an upper limit of 0.4 grain of solids per cubic foot of gas, but they also set a ceiling on dust emission

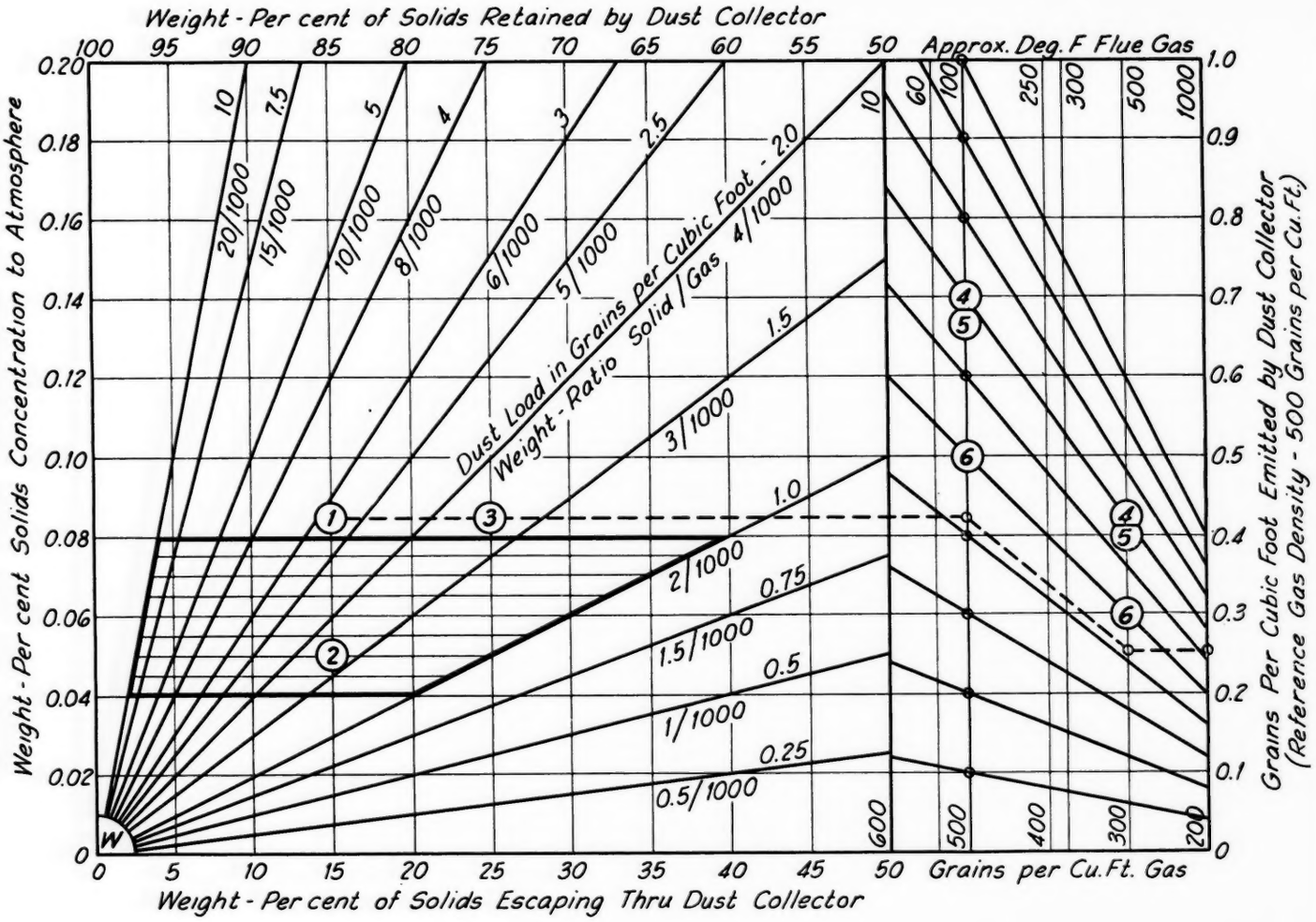

Weight - Per cent of Solids Retained by Dust Collector
Approx. Deg. F Flue Gas
Weight - Per cent Solids Concentration to Atmosphere
Grains Per Cubic Foot Emitted by Dust Collector (Reference Gas Density - 500 Grains per Cu. Ft.)
Dust Load in Grains per Cubic Foot - 2.0
Weight - Ratio Solid / Gas
Grains per Cu. Ft. Gas
Weight - Per cent of Solids Escaping Thru Dust Collector

Fig. 2. Dust loading and collection efficiency diagram with temperature correction chart; numbered points represent permissible emissions as follows: (1) ASME Model Ordinance (1949), approximately 0.25 gr per cu ft at 500F; (2) Allegheny County (1949), new blast furnaces, approximately 0.15 gr per cu ft at 500F; (3) Allegheny County (1949), foundry cupolas, approximately 0.25 gr per cu ft at 500F; (4) Cleveland (1949), 0.425 gr per cu ft at 500F; (5) Los Angeles (1949), 0.4 gr per cu ft (see discussion); (6) Detroit (1947), 0.3 gr per cu ft at 500F.

at 40 lb per hr from any one stack. This does not mean, however, that all stacks may emit 40 lb per hr. The maximum permissible pounds-per-hour emission is determined by the total weight of raw materials entering the process, and only when this weight reaches 60,000 lb per hr does the ceiling value of 40 pounds apply. For smaller raw material weights, the maximum discharge weight is correspondingly reduced, although not in direct proportion. It ranges from 0.067% at 60,000 lb up to 0.48% by weight at 50 lb per hr. (The relationship in the range of 300 to 30,000 pounds is approximately:

$$W_e = 0.042\ W_p^{0.6}$$

where W_e is the emission rate and W_p is the total process raw material weight, both in pounds per hour.)

Fig. 2 is a graphical presentation of the relationships between several methods of specifying the allowable emission of solid materials from dust collecting equipment. By use of a correction chart at the right of the graph, various temperature conditions can be converted to the reference scale, which in this case is based on an arbitrary gas density of 500 gr per cu ft. This density has been chosen admittedly for its mathematical convenience, which is a highly desirable feature in a field so much confused with multiple units and reference temperatures.

From the graph it is readily seen that compliance with an emission concentration of 0.4 gr per cu ft of gas at 100F, or a dust concentration of 0.08% by weight, requires a cleaner capable of separating 80% of the solids from the gas stream when the initial loading is described as: (a) 2 gr per cu ft; (b) 4 lb per 1,000 lb of gas (4 lb per kilopound); or (c) 4 grams of solids per kilogram of gas.

The area lightly shaded with horizontal lines indicates the range applying to most cupola dust collection problems. A few cupolas will discharge solids at a substantially lower concentration due to high rates of gas dilution before release to the atmosphere. In fact, with sufficient dilution, it is possible to comply with many ordinances without the installation of gas cleaning devices.

Section 609-B of the new smoke control ordinance of Allegheny County, Pennsylvania, effective June 1, 1949, provides that:

"No person shall cause, suffer or allow to be emitted into the open air from any cupola contracted for, under construction, or in operation subsequent to the enactment of this Ordinance, fly ash in the gases to exceed

0.85 lb per 1,000 lb of gases, except it shall not be required that the fly ash eliminated shall be greater than 75% of the total fly ash. Cupolas contracted for, under construction, or in operation prior to the enactment of this Ordinance shall be subject to the requirements of this section five (5) years subsequent to the enactment of this Ordinance."

Wind velocity and direction are important as they affect the pattern of distribution of the heavier solids. When the velocity is around 5 mph, most of the dust settles on the foundry roof near the cupola; when the velocity is 25 mph, a substantial portion of the heavy particles deposits on adjacent roofs and grounds. However, for the finest solids and for gaseous contaminants, a high wind velocity may be considered an advantage in some communities, since it tends to disperse and dilute the contaminants throughout a larger mass of atmosphere—sometimes to the distress of neighboring communities.

Because there is interest in both the deposited heavy dust and the fine particulate matter that remains in suspension for some distance from the stack, it is customary to determine the total weight of solids in cupola gases, including all sizes discharged from the stack. With such a procedure, it is rather important that some information also be given concerning the size distribution of the dust, in order to assist the dust control engineer in devising methods having a proper combination of cleaning stages for economical performance against the various particle size groups.

Solid and Gaseous Sulfur Compounds

If the sulfur content of the coke can be kept below 1%, which is desirable both metallurgically and meteorologically, the total sulfur concentration in the stack gas will be less than 0.1% by weight, even without dilution by air entering the charging door. This amount of sulfur should not be translated wholly into the gaseous form SO_2 when predicting the possible destination of sulfur in the charge. The probable distribution of sulfur between the gaseous and solid forms is a matter of some speculation at this time, since very little data has accumulated on this point. Only recently, as an outcome of the widespread publicity on the smog-forming* potentialities of sulfur dioxide and trioxide, has there been any concern for the small amounts of sulfur emitted by foundry cupolas.

Table 2 is an outline of the method of analyzing the origin and destination of sulfur in the cupola melting process. For each case a similar analysis can be made in the absence of stack gas determinations for sulfur. However, the procedure outlined is dangerous if the restrictions on sulfur emission are severe. Only by careful sampling and analysis of the effluent gas over a period of time sufficient to provide a convincing record of the average concentration and its range of movement, can a proper appraisal be made of the extent of air pollution by a given source.

Hemeon and Hatch (6) of the Industrial Hygiene Foundation, Mellon Institute, have indicated that ".... sulfur dioxide has been studied extensively with respect to its capacity for damaging vegetation. The maximum safe concentration has been determined, and it is now considered good practice to operate plants producing this gas in such a manner as to avoid ground-level concentrations in excess of 0.5 to 0.75 part per million (by volume). This standard is unique in that no other atmospheric contaminant has received such scientific assessment."

The Los Angeles County air pollution regulations permit the discharge of 0.2% or 2,000 parts per million by volume of sulfur compounds, computed as sulfur dioxide, at the point of emission. The relationship between stack concentration and ground-level concentration can be mathematically predicted in general order of magnitude, but extended air and gas sampling would be necessary in the event of controversy. It appears, however, on the basis of all data available,

TABLE 2—SULFUR BALANCE IN THE OPERATION OF A FOUNDRY CUPOLA

An idealized example of conventional operation with side charging door open, a melting rate of 10 tons of iron per hour, and a one-hour period during the heat.

Pounds per hour	Materials	Symbols	Ratios*
20,000	Iron and steel charged	Fe	
2,500	coke charged (above bed-coke)	C_k	$Fe/C_k = 8.0$
25	sulfur brought in with coke	S_k	$S_k/C_k = 0.01$
20	aggregate of sulfur in metal charge	S_a	$S_a/Fe = 0.001$
45	total sulfur entering cupola	$S_a + S_k$	
20,000	air blast (note this is in pounds per hr; about 26,000 cu ft per ton of iron)	A_b	$A_b/C_k = 8.0$
22,000	effluent gas from combustion zone	G_c	$G_c/A_b = 1.1$
8,000	dilution air induced through charging door of 12 sq ft area at 150 cfm per sq ft	A_i	$A_i/G_c = 0.36$
30,000	combined gas and air leaving stack	G_s	$G_s/G_c = 1.36$ $G_s/A_b = 1.5$
1,500	slag removed from melting zone (including loss of 5%)	W_s	$W_s/Fe = 0.075$
28.5	sulfur removed in molten iron (before desulfurizing in forehearth, if used)	S_z	$S_z/S_a = 1.5$
4.5	sulfur removed in the slag	S_s	$S_s/W_s = 0.003$
12	sulfur carried up with stack gas	S_g	
45	total sulfur leaving cupola	$S_z + S_s + S_g$	

Concentration of Sulfur in the Effluent Stack Gas

$12/30{,}000 \times 10^6 = 400$ parts sulfur per million parts of gas by weight

$S_g/G_s = 0.000{,}400$

Assuming that as much as 50% of this sulfur is discharged in the gaseous form as SO_2 (remaining sulfur present as particulate compounds):

$$400 \times .50 \times \frac{64}{32} = 400 \text{ ppm sulfur dioxide by weight}$$

$SO_2/G_s = 0.000{,}400$

400 ppm by weight times 30/64 equals 188 ppm by volume. (30 is the assumed molecular weight equivalent of cupola stack gas; 64 is molecular weight of sulfur dioxide; 32 is atomic weight of sulfur. Note that the dilution ratio G_s/G_c is only 1.36 in this example.)

*The usual ranges for these ratios are given in Table 3.

*"Smog," originally referring chiefly to the combination of coal smoke and fog, is currently applied to water fog contaminated by any gaseous or particulate matter.

that the concentration of sulfur dioxide at the point of discharge from most foundry cupolas will be far below 2,000, and well below 1,000 parts per million by volume.

Sampling and Analysis of Cupola Emissions

It is not within the scope of this discussion to present the details of gas sampling and analysis of cupola emissions. A thorough project involves elaborate equipment capable of separating the constituents into several fractions for analytical treatment. It can be readily appreciated that such a project would be in the nature of research, and that routine or periodical testing for emission control purposes must be limited to the essentials established by a few comprehensive studies. So far, it seems evident that determination of total solids concentration or mass emission rate, and separation of the collected material into several size ranges to indicate its distribution, will satisfy most of the current regulations. In a few areas where adverse topographical or meteorological conditions prevail, it may be necessary to add gaseous and particulate sulfur determinations to the sampling project.

Available sampling procedures can be adapted to cupola gases even though temperatures may be quite high (7, 8, 27). It is best to have such work done by testing laboratories, consulting chemists or engineers, or specialists in the field of air pollution control and smoke abatement.

Where continuous observation of the character of cupola emissions is desired, it is possible to adapt the recording and indicating instruments developed for blast furnace and power plant emissions (9-13). This will be particularly valuable in controlled research on the performance of various systems of gas cleaning where simultaneous samples before and after the cleaner are desired, and where variations in magnitude and with time are factors to be examined.

If the distribution of a certain element between molten iron, slag, gaseous emissions, and dust is under study, the use of a radioactive isotope in the charge may facilitate production of continuous performance records of special interest to the metallurgist.

Part II – Methods of Gas Cleaning

The varieties of gas cleaning equipment are practically unlimited. For this reason, the following list of systems chiefly refers to the methods of applying such equipment and of operating the cupola. Some of these groups may be further subdivided according to the methods of dust separation, and whether operated dry or wet, or with a dry-wet combination.

Type A—Open Top Cupola

(1) Deflection cap, cone, or baffle; natural draft (reference 3, and Fig. 3)
(2) Expansion-gravity separator; natural draft
(3) Induction-expansion chamber; natural draft (Fig. 4)
(4) Deflection-expansion chamber; natural draft (Fig. 6, 7, and 8)
(5) Centrifugal deflection-expansion; natural draft (Fig. 5)
(6) Gas downflow; mechanical exhaust from side to cleaner

Fig. 3. Cupola with standard spark arrester (Type A-1) and side charging mechanism. Courtesy, Whiting Corp.

Type B—Closed Top Cupola

(1) Closed charging door or port; airblast-powered gas cleaning system (pressure method)
(2) Open charging door; constant volume mechanical exhaust to cleaner (suction method)

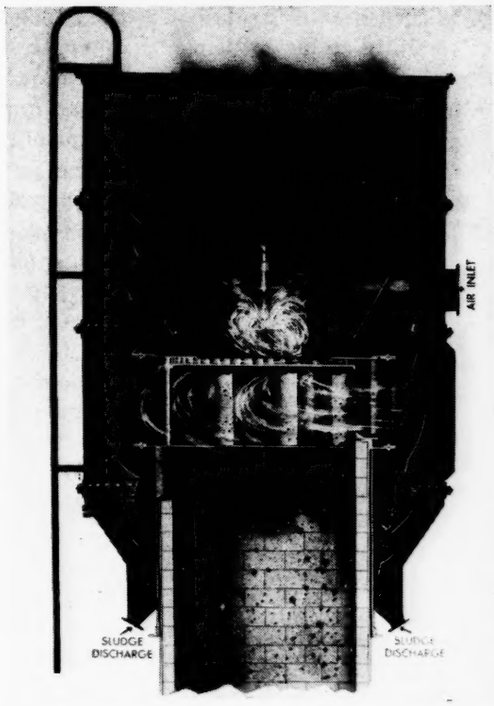
Fig. 4. Induction-expansion wet dust arrester based on design by E. A. Piper (Type A-3). Courtesy, C. O. Bartlett & Snow Co., Cleveland.

(3) Closed charging door; constant volume mechanical exhaust to cleaner, air by-pass for draft compensation (suction method)
(4) Closed charging door; variable-speed mechanical exhaust to cleaner, interlocked to blast air blower (suction method)

Open Top Arrangements

One of the earliest types of spark and cinder control, which is still in use, is the "birdscreen" arrester, generally applied to the circular space between a weather cap and the top of the stack (Type A-1). Since the screen must be coarse enough to prevent excessive resistance to gas flow, it cannot retain any but the largest chunks of material reaching that level. Even less effective are chains suspended from the rim of a weather cap.

Type A-1 also includes the deflection of heavy particles toward the side of the stack by substantial baffles or inverted cones mounted below the top of the stack.



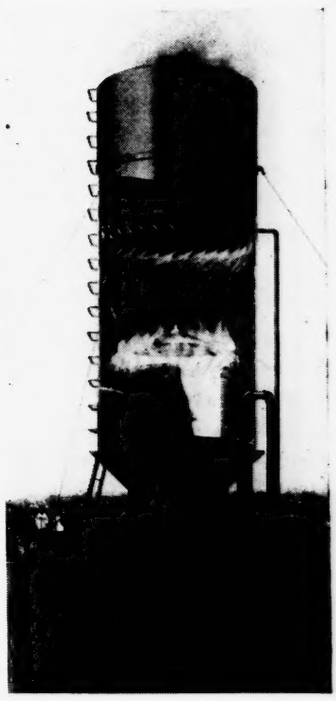


Fig. 5. (Left) Section of Type A-5 cupola dust collector. Courtesy, Whiting Corp. Fig. 6. (Right) Early experimental 2-stage cupola gas washer; first stage Type A-4-a, and second stage Type A-4-d. Courtesy, Whiting Corp.

In view of the relative coarseness on the micron scale of a large portion of the solid constituents, it has been possible to precipitate from 50 to 75% of the dust load from the gas stream by a simple expansion chamber or cylindrical shell "telescoped" over the top of the stack (Type A-2). The addition of a water spray inside this chamber increases the amount of finer particles that can be deposited, and makes use of the water for hydraulic transport of the dust.

The annular space between the collector shell and the cupola stack is either open or closed at the base, depending on the method of handling the dust or sludge, and whether it is desired to induce air from the atmosphere for cooling the gas by dilution (assuming that combustion will not take place at the point of air induction—which in fact has been observed to occur in a few cases). Type A-2 is the closed-shell method, and Type A-3 (Fig. 4) uses the open shell for air induction (26). Entwisle and Gass, Bolton, England, designed an induction Type A-3 arrester with a square expansion chamber, which was described in 1932 (15).

If a cone is mounted above the stack inside an expansion chamber or hood (Type A-4), it is possible to augment the deflection-expansion process by the addition of water sprays or sheets. The free area between the rim of the cone and the shell is usually from two to four times the area inside the cupola stack at its top. This is the general class to which most of the current methods of cupola dust collection belong. Water has been applied in numerous ways, somewhat as follows (subdivisions of Type A-4):

(a) open water line centered above apex of cone, water flow by gravity (Fig. 6);
(b) single spray nozzle mounted above apex of cone (Fig. 7);
(c) cluster of nozzles above and near center of cone, arranged horizontally or vertically;
(d) ring of nozzles above cone inside shell and directed toward cone (Care must be taken in this case to use wide-angle spray patterns to avoid gaps between nozzles through which gas may escape unwashed. See Fig. 6.);
(e) cone made hollow, water discharged from hole in apex and flowing downward by gravity (16);
(f) cone made hollow, water issuing in sheet from continuous slot at periphery (slot size regulated by spacers fastened at intervals);
(g) cone made hollow, water issuing from nozzles mounted at periphery (original system at Buick Motor Division, GMC; reference 17);
(h) small removable water-distributing head mounted above main cone, water issuing at low pressure from an adjustable slot at periphery of small cone (Fig. 8).

A few installations of the deflection-expansion Type A-4 arrester have been made without the use of water, and arranged to serve two cupolas, either simultaneously or alternately. In this case the dry dust is funneled into a hopper placed at any convenient level (18).

In Type A-5 (Fig. 5) the gas passes into the center of a stationary centrifuge where it is mixed with air and water and forced outward toward the collector shell. The auxiliary air stream producing the swirling motion of the gas is supplied by a blower with its discharge duct connected tangentially to the swirl chamber (19).

Type A-6 represents a method of mechanical exhaust which does not require closing of the top of the stack. A sufficient volume of exhaust is applied at a point above the stock line so that air enters not only through the charging door, but also into the top of the cupola

(20). The gas and air mixture is then drawn through suitable stages of dry and wet cleaning. This system has been used to a limited extent, but excessive heat has made it difficult to maintain the moving parts of the equipment in good condition. This, of course, would apply also to Types B-2, B-3, and B-4, in the absence of substantial gas cooling by dilution with air, or by vigorous washing ahead of the exhaust fan.

Closed Top Arrangements

The closed top system (Type B-1) described by Drake, Kennard, and Saylor (21), approaches in principle the favored method of handling blast furnace gas, which is a by-product of sufficient value to warrant a high standard of cleanliness (1, 22, 23). This system practically reverses the conventional method of cupola operation. Instead of side charging of stock and top removal of gas, their arrangement provides for top charging of stock through an air-lock chamber containing a charging bell, and side removal of gas from this chamber. The gas is forced through at least two stages of cleaning, first dry, then wet, by the pressure created by the blast air blower.

Type B-2 is a relatively simple method of producing a closed top system of dust control (24). The suction method with sufficient exhaust air and gas volume has the advantage that the charging door may be left open without danger of gas escape at the charging level. Furthermore, any leaks developing in the system will result in an inward flow of air at those points, which prevents the escape of toxic carbon monoxide gas into the foundry. This system requires the use of an exhaust fan to draw gas into the cleaning equipment and

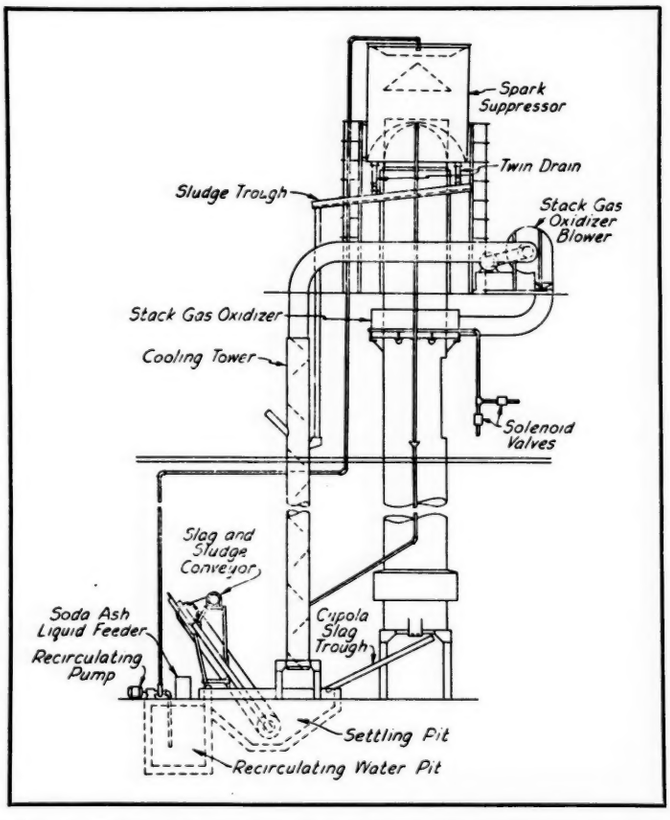


Fig. 7. Assembly of cupola with spark arrester (Type A-4-b), stack gas oxidizer, cooling tower for scrubbing water, settling pit, and water recirculation system. Courtesy, Whiting Corp., Harvey, Ill.

the cupola cannot be operated if the exhaust fan is out of order.

The quantity of dilution of combustion gas, which has an important bearing on the size of dust collecting equipment, can be regulated by the size of the charging door or by partially closing the door between intermittent periods of charging.

Type B-3 is similar to Type B-2, but permits closing of the charging door in the event of intermittent charging. It requires an air bypass arrangement between the cupola and gas cleaner to admit air to the duct in an amount similar to that entering the charging door when open. Since the admission of air would burn a gas rich enough in carbon monoxide and high enough in temperature, such a draft bypass device would require an especially effective heat resistant construction, as also would the exhaust duct to the gas cleaning system. Thus it would not be chosen in preference to Type B-2 unless heat suppression near the charging door were imperative.

Furthermore, the hazard of flash-backs or sudden explosive ignition of gas meeting air entering a bypass or inlet bleeder, if carbon monoxide were well above the lower explosive limit of 12.5%, would seem to place this method in a most unfavorable light compared with prompt burning of the gas at the charging door. On the other hand, if the gas is kept in a well closed system until it reaches a combustion chamber with a carefully regulated air supply, as in the Griffin* system (3), the explosion hazard can be minimized.

The above comments on explosions refer to combustible gas from the melting zone. The designer should also keep in mind the potential forces of explosions that have occurred within cupolas where loaded ammunition or sealed hollow castings have entered the charge accidentally.

At this point it is proper to warn that there is little reason to be complacent about the reliability of gas explosion preventive measures in the design or handling of a cupola. The operating crew must at all times be on the alert for signs of trouble, but the best precaution is the elimination of explosion hazards by good engineering.

Type B-4 is not known to be in use; it would require very close regulation of the exhaust capacity of the fan on the dust collector to keep in step with any variations in airblast quantities. It is included in this list of arrangements to further emphasize a preference for Type B-2 when a suction method of gas removal is desired with a closed top cupola.

Dry Versus Wet Systems of Gas Cleaning

A decision for or against the use of water with a cupola dust collection system is primarily the result of a series of considerations whose individual importance must be rated for each foundry. With this in mind, a check-list of items for study has been assembled and is offered here for reference. Included in this list are relevant points discussed elsewhere, together with a few observations requiring no further comment. Some

*The Griffin hot blast cupola developed by the Griffin Wheel Company, Chicago, is not a closed top cupola but it provides for the confined removal of combustion gas below the charging door and passage through heat exchangers using both sensible and latent heat.

of these points are in the nature of warnings to those who are required to make selections from several designs of the same type of collecting equipment.

Advantages of Wet Systems

(1) Improved collection of the finer fractions of insoluble as well as soluble dust. Better collection is chiefly the result of (a) moist contact surfaces that resist the tendency of dust re-entrainment by turbulent gas; (b) contact of small particles with larger droplets easier to remove from the gas stream by kinetic forces; (c) possibility of increasing the mass of particles by adsorption of water; and (d) reduced volume and velocity of gas by cooling, and thereby its particle transport ability.
(2) Possibility of removing part of the gaseous sulfur from the stack gas.
(3) Cooling effect of water on the collector elements.
(4) Quenching of incandescent particles as a fire prevention measure; note, however, that effective fireproof dry collectors also can prevent the escape of incandescent particles large enough to be dangerous.
(5) Practicability of using waste water from other processes, even at temperatures up to 120F.
(6) Possible transfer of sensible heat in the gas into sensible heat of water for use elsewhere in the plant after suitable clarification.
(7) Convenience of hydraulic transport of the dust.
(8) Possibility of combining several wet dust collector sediments in a single dewatering installation. This includes the piping of collector sludge into a slag quenching and granulating system.
(9) Reduction of the abrasive effect of heavy particles by the lubricating effect of water.
(10) Ease of applying water to most types of dry dust collectors, making suitable provision for protection of the cupola charge against drenching when the collector is mounted on the stack.

Disadvantages of Wet Systems

(1) Need of special pumping equipment where water supply is limited, or where available pressure cannot lift the water to the top of the cupola. Note here that with a Type A-3 washer (Fig. 4), water flow must be stopped in case pressure falls too low to sustain a proper throw toward the collector shell.
(2) Hardness of water supply, with attendant possibility of troublesome maintenance due to spray nozzle plugging (can be overcome to a considerable extent by proper design of water distribution element).
(3) Possibility of a severe corrosion problem due to excessive sulfur in the fuel; even so, the expense of chemical neutralization may be justified in order to help retain the gaseous sulfur.
(4) Possibility of damage due to corrosive or muddy mist settling near the stack, especially in cold weather as a result of greater amounts of condensation.
(5) Danger of freezing during shut-down periods in severe climate if equipment is of such design that it cannot be effectively drained from all points (proper drainage is both an anti-corrosion and anti-freezing necessity).
(6) Severe local limitations on stream pollution (effluents from dewatering tanks are generally rated as satisfactory for discharge into sewers and streams).

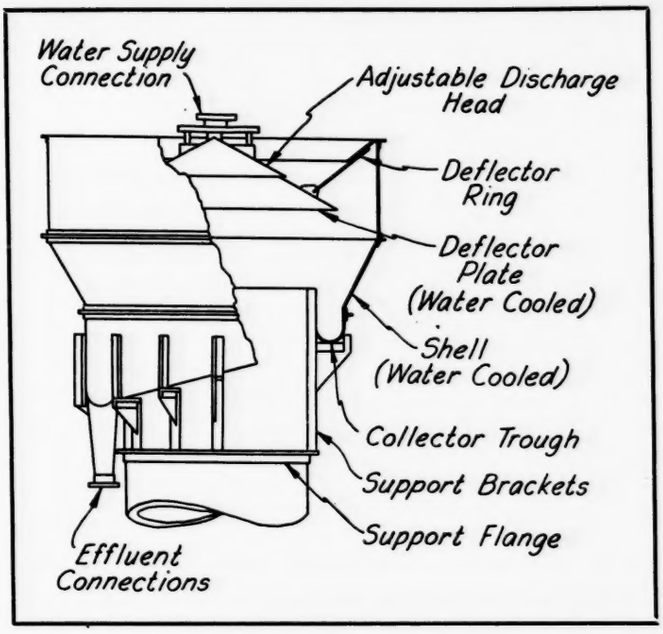


Fig. 8. Adjustable water-discharge head for wet dust collector (Type A-4-h). Courtesy, C. B. Schneible Co., Detroit.

Advantages of Dry Systems

(1) Retention of sensible heat in the gas for transfer to the blast air in a dry heat exchanger, wherein the latent heat of carbon monoxide also may be recovered.
(2) Possibility of recovering both the soluble and insoluble solids in the dry form (though generally considered worthless, except for land-fill purposes).
(3) Minimum corrosion activity.
(4) No danger of interruption of the melting process if collector is at top of the stack, which might be necessary if collector preservation depends on water cooling.
(5) Better dispersion of gas in the atmosphere due to additional buoyancy at higher exit temperature when heat is not recovered.

Disadvantages of Dry Systems

(1) Necessity of high temperature resistant construction unless equipment is sufficiently large to permit high gas dilution ratios.
(2) Difficulties anticipated in handling the collected dust dry, making it advisable to convert it to a sludge before transport, in which event a wet system using hydraulic transport would be an advantage.
(3) Inability to reduce the gaseous sulfur concentration in areas where required by regulation. (Reaction chambers or filters packed with alkaline materials or sorbents could conceivably overcome this objection to a dry system, but equipment size and

necessity for periodic regeneration would make this method a poor choice for large cupolas.)

Dry Systems of Gas Cleaning

The effect of gravity is of special advantage in the control of cupola dust: any particle too heavy to be steadily supported by the upward velocity of the waste gas settles back into the stack, or into an expansion type dust catcher at the top. In other words, the terminal velocity of the particle is greater than the upward component of the gas velocity. For this reason, the terminal - velocity - distribution of cupola dust is the most direct measure that can be made to indicate the prospects of retaining the dust in a natural draft collector of the expansion type.

For gas treatment systems using an exhaust fan, numerous dry cleaning devices are available. They may be applied either as single stage cleaners, or as primary cleaners, according to blast furnace practice. They include cyclones, centrifugal fan separators, impact chambers, zig-zag baffle arrangements, and down-up expansion chambers of the type described by Kling (5).

Quite recently, an aerodynamic filter or louvered cone concentrator has been applied on a dry system in this country where the sensible heat is recovered from the cupola gas.*

Dry filtration by woven fabrics has always been a good competitor in applications where the smallest particle sizes must be removed. A serious limitation is the temperature of the gas stream, for it must be kept below the charring or disintegrating point of the fabric. High-temperature-resistant fabrics, such as glass, asbestos, or synthetic fibers, have raised the practical temperature of exposure, and thus have brought more applications into the range of true filtration.

Nevertheless, the ability to remove very fine particulate matter from air or gas by the use of densely woven fabrics brings with it a number of important disadvantages: (1) necessity of a special dedusting or periodic rapping mechanism to free the fabric of part of its dust load; (2) necessity of frequent inspection of the fabric and its supporting framework for leaks developed by the rapping process, or for uneven plugging; (3) cyclic variation in the resistance encountered by the gas stream due to build-up of dust on the fabric, which results in cyclic variation in the volume of gas flow.

Dry fabric filtration is a superior method of particle removal capable of producing gas suitable for use in combustion engines, or for delivering air clean enough to breathe. It is not likely that cupola gas will receive this kind of treatment for some time to come, and only then if the gas is not wasted directly to the atmosphere.

*Manufactured under the Linderoth patents pending.

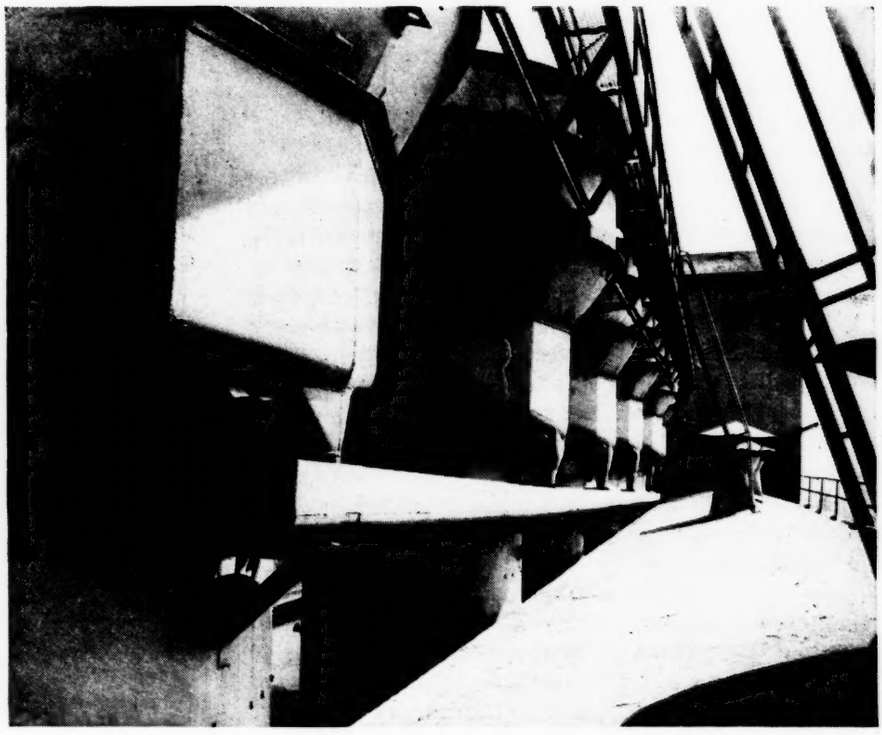


Fig. 9. Sludge trough for a group of 6 cupola gas washers. Buick Motor Division, GMC.

High-voltage electrostatic precipitation is another heavy-duty gas cleaning process that is usually operated dry. It can be installed as a combination settling chamber and fine-particle trap, but even alone it requires much space. Its well-known ability to collect fine particles in the vicinity of 1 micron is a class of performance currently regarded as unnecessary for cupola gas, which is still almost universally exhausted to the atmosphere without any attempt to recover part of its heat content.

Advocates of wet methods have suggested that they eliminate the danger due to falling sparks. It is believed, however, that any good method of dry collection which can stand the heat and will arrest particles only as small as 100 microns, will eliminate the spark hazard by retaining the incandescent particles. Smaller particles are too rapidly cooled in open air to be a real fire hazard.

Special Considerations in the Use of Water

The primary water supply as well as the make-up water for a wet dust collector may be (a) piped from the municipal system, (b) pumped from a nearby stream, or (c) relayed from another water-using process such as condensers or dust collectors. Water rates vary from 0.2 to 2.0 lb per lb of cupola gas treated, or from 20 to 300 gpm per cupola, according to the size of cupola and the arrangement of water break-down and distribution. Evaporation loss will range from 10 to 50% of the water circulated, the higher ratio applying only to the lowest rates of flow; in fact, an excessive ratio of evaporation loss is an indication of inadequate water flow.

In many cases a large proportion of the water deliv-

ered to the collector is recirculated from a settling tank or sump, possibly having been treated with soda ash (sodium carbonate) to neutralize the acid or assist in the retention of sulfur dioxide (Fig. 7).

Water pressures are relatively low from the viewpoint of gas cleaning, generally less than 50 lb per sq in. gage at the collector. This means that such devices are not classified as fog washers, where pressures are generally from 100 to 400 lb per sq in. gage. In view of the substantial conversion of sensible heat into latent heat of vaporization, it has not been wise to break the water down too near to fog sizes, as this would result in a second collection problem—that of removing an excessive quantity of fog from the gas. The finer droplets not removed will carry away solid particulate matter until complete evaporation leaves the solids suspended in the atmosphere; the larger droplets will settle to the ground. A small amount of particulate water loss is inevitable, as also is the steam fog that identifies a cupola stack equipped with a gas washer (Fig. 5 and front cover).

Water temperature at the downspout from a washer at the top of a cupola is held preferably below 180F to avoid excessive vaporization. From the viewpoint of heat transfer, the smaller the amount of water required to carry away a fixed quantity of heat at a given rise in water temperature (100 to 160, for example), the more effective is the scrubber as a heat transfer device. This in itself suggests a more intimate mixing of water and gas with a higher potential dust-removing ability.

An estimate of the quantity of heat carried away by the combustion gas is desirable if a study is made of heat absorption and vaporization loss with a wet method of gas cleaning. Those who are interested in making such computations are referred to the AFS Handbook of Cupola Operation, pages 365-373, for a detailed presentation of the method of determining a heat balance for a ferrous foundry cupola. An approximation of the quantity of heat in the stack gas when the temperature is known, can be made by assuming a constant-pressure specific heat of 0.25 Btu per pound of gas per degree F.

The high water temperatures associated with minimum water rates and recirculation make it difficult to retain sulfur dioxide; from the viewpoint of corrosion control, this is an advantage. The few cupola gas analyses that have been made for sulfur dioxide indicate concentrations that are relatively low, less than 250 parts per million by volume. For this reason, the conventional washers on cupolas have not been designed to be effective gas absorbers, and it appears that in most localities it is not necessary to plan such performance. Accordingly, it is reasonable to operate a water recirculating system without attempting to cool the water to a point such as 60 or 70F with the object of increasing the solubility of sulfur dioxide.

Any scheme that depends on a water distributing manifold above the stack should be designed for easy access to interior surfaces. If not removed periodically, the scale or precipitate that forms within the manifold from hard or recirculated water and breaks loose, will clog the nozzles or distributing pipes.

Since uninterrupted water supply is important, not only from the air pollution standpoint, but also to prevent overheating and warping of the dust separating elements, it is wise to provide dual pumping equipment so that one set can be put into service the moment the other goes out of commission. A drop in the water pressure below a specified level is used to actuate the spare pump switch, and in case both pumps fail to deliver the necessary pressure, the cupola blower may be shut down automatically. Conversely, a rise in water pressure due to plugging of nozzles or piping can be made to actuate a warning device or interrupt the cupola blower.

The scrubbing water from cupola washers has been found to be either acid or slightly alkaline, depending on the relative amounts of compounds of sulfur, calcium, and magnesium collected, and the rate of recirculation. Gas washing equipment installed at the top of cupolas can be constructed without the use of stainless steel when the flow of water is great enough to flush down all corrosive sediment from the collector, and when the condition of the recirculated portion is checked periodically to guard against the accumulation of high acidity.

In view of the large quantity of solids carried by the stack gas, it is necessary to provide settling pits, tanks, or basins wherein the scrubbing water can deposit its load. In some types of wet collectors, the settling process takes place at the base of the equipment and a mechanical conveyor removes the solids at a sufficient rate to prevent choking of the collector.* The clarified waste water is then recirculated, relayed to another water-using process, or piped to the sewer or stream. If a slag quenching and granulating system is available, the water from cupola dust collectors can be run directly into this system, together with scrubbing water from other dust collection systems—for example, an exhaust system installed over the slag spout to capture slag "wool" (3). The combined sludge is then delivered to the settling pit for separation.

Installations for dewatering or thickening the flue dust sludge have ranged from rather simple pits, or bath-tubs, to conveyorized mechanisms of various designs. For large quantities of dust, the unit thickeners or clarifiers used in related industries can be applied (25).

Either dry dust or sludge removed from cupola gas cleaning systems is currently regarded as worthless, except for land-fill use. If the dust becomes part of the slag, its destination may be either the slag dump, or in granulated form as aggregate for cinder blocks, as road ballast, or rough road surfacing.

Air Blast Conditioning

Attempts to condition the blast air before delivery to the melting zone are not recent by any means. Early literature indicates that recovery of heat from the waste gas for transfer to the blast air has been in limited use for over 100 years, and the possibility of improved operation by the use of a dry blast has been known for at least 50 years.

The advantages of preheating the blast air are now

*Make certain that a water overflow pipe is provided to prevent flooding in case sludge removal equipment suddenly goes out of order.

well recognized by foundrymen. When some of the heat required to melt the iron can be obtained from sources exterior to the melting zone, better control can be established over the metallurgical chemistry of the process. The decision to use hot blast is based accordingly on a combination of factors divided between economics and metallurgy.

In the case of foundry cupolas, which are generally operated intermittently or on alternate days, an important disadvantage of depending entirely upon the sensible and potential heat in the waste gas is the time interval between starting the blast and the period of maximum blast temperature. Thus, in some foundries, the blast is heated instead by small auxiliary plants that provide the desired air temperature at the time the blast is turned on. This method also facilitates the

TABLE 3—SUMMARY OF WEIGHT-RATIOS IN CUPOLA OPERATION

Usual or recommended ranges are shown; when upper and lower limits are known, they are given outside parentheses enclosing usual ranges.

Weight-Ratios	Symbols	Ranges	Comments
Iron/Coke "coke ratio" "melting ratio" "fuel ratio"	Fe/C_k	4 (7-10) 14	does not include bed-coke
Iron/Carbon	Fe/C	5 (8-11) 16	assuming $C = 0.9\ C_k$; see AFS Handbook, pp. 78-91, for charts on cupolas of 36 to 72-inch lined diameter
Air/Carbon	A_b/C	5.7 (7-10) 11.5	30 to 100% "combustion efficiency" in producing CO_2; see AFS Handbook, pp. 100-101
Air/Coke	A_b/C_k	5 (6-9) 10.5	90%-carbon coke
Air/Iron	A_b/Fe	0.5-1.5	non-oxygenated blast; about 13,000-39,000 cu ft per ton of iron at 60F; low ratios with hot blast
"Stage of Combustion" (carbon dioxide content of the effluent gas from the combustion zone)	CO_2/G_c	0 (10-15) 21	this ratio is related to: combustion efficiency, melting efficiency, temperature of molten iron, losses of silicon and manganese; see AFS Handbook, pp. 99-102, 376-377. Note that this is not CO_2/G_s when charging door is open.
Nitrogen/Air	N_2/A_b	0.75	for dry air; use in checking ratio G_c/A_b below
Nitrogen/Combustion gas	N_2/G_c	0.63-0.68	use nitrogen as tracer in computing mass flow relationships for gases
Combustion gas/Air	G_c/A_b	1.2-1.1	"combustion gas" as used here is also known as "effluent gas" with reference to the combustion zone
Combustion gas/Carbon	G_c/C	7 (8-11) 13	
Combustion gas/Coke	G_c/C_k	6 (7-10) 11.5	
Combustion gas/Iron	G_c/Fe	0.6-1.8	
Gas mixing ratio: induced air/combustion gas	A_i/G_c	0-5	both mixing and dilution ratios depend on size of charging door if open, strength of updraft, height of stack, resistance of dust collector; will be high with low melting rates in large cupola lined below charging door to a diameter considerably smaller than rated size
Gas dilution ratio: stack gas/combustion gas	G_s/G_c	1-10	
Slag ratio	W_s/Fe	0.05-0.10	includes iron loss
Sulfur pick-up	S_z/S_a	1.4-1.6	40 to 60% of aggregate sulfur content in iron and steel charged; AFS Handbook, p. 54
Sulfur dioxide concentration in stack gas	SO_2/G_s	0.00005-0.0005	0.005-0.05% by wt., 50-500 ppm by wt., approx. 25-250 ppm by volume
Dust/Iron	D_i/Fe	0.005-0.025	0.5-2.5%; 10-50 pounds per ton of iron melted
Dust/Combustion gas	D_i/G_c	0.005-0.015	0.5-1.5%; 5-15 pounds per kilopound of gas or air; more significant than D_i/G_s, which is subject to wide variations due to induced air at charging door
Dust concentration in stack gas before cleaning	D_i/G_s	0.0005-0.025	0.05-2.5%; hourly average concentrations
Dust concentration in stack gas after cleaning	D_o/G_s		
Dust collected/Stack gas	D_d/G_s		
Water/Stack gas	L/G_s	0.2-2.0	note that G_s does not include amount of air induced above cupola stack by dust collector itself
Overall efficiency of dust collection system; see ASME Power Test Code for Dust-Separating Apparatus: PTC-21.47-1941	$E = D_d/D_i$ $E = D_d/(D_d + D_o)$ $E = (D_i - D_o)/D_i$ $E = \dfrac{D_i/G_s - D_o/G_s}{D_i/G_s}$		estimates of relative efficiencies of various types of cleaning systems against cupola dust are not in order at this time. assuming in the last formula that no change has occurred in the mass flow of gas through the cleaning system.

installation of air moisture control equipment when the size of the operation or quality of iron warrants the expense.

The possibility of using the waste gas as a source of heat for the blast depends, among other things, upon the cleanliness of the gas. An excessive dirt load will make the servicing of heat transfer equipment so costly that other sources of heat, either coal, oil, or gas, become more economical. A similar situation occurred years ago during the evolution of gas cleaning equipment for the blast furnace before the recovery of waste heat became general practice. Early failures to provide a sufficient degree of dust removal from the gas before passing it to blast heating stoves or to gas engines gave opponents of the innovation a few years of temporary attention.

In the present argument, the practicability of recovering a substantial part of the heat in cupola gas will depend on developments in economical and effective removal of the finer portion of suspended particulate matter. It has now been generally agreed in the field of dust collection for industrial process ventilation that excessive maintenance requirements imposed by any system of collection are sufficient cause for seeking a more appropriate method of separation. The same applies to the development of dust collection devices for the cupola: the system must operate with the best possible cleaning efficiency for the least possible attention. Air or gas cleaning equipment receives only casual attention between periods of emergency servicing.

The foregoing comments are part of the debate on the economics of closed-top versus open-top cupola operation. In a sense, the history of the blast furnace on this point is being repeated, though the circumstances are quite different. We know far more now about the character of dust-laden gases and the techniques of separating solids from gases. Nevertheless, it is well to ponder the fact that a good many attempts to control the dust emitted by foundry cupolas have fallen into the category of misguided enthusiasm, chiefly because the nature of the gas cleaning problem has been hastily judged without a sound knowledge of the behavior of contaminated gases.

While the debate gathers momentum on the economics of cupola gas heat recovery versus air pollution abatement, the dust control engineer and the foundry engineer will need to devise means of reducing the quantity of solids discharged into the atmosphere from existing cupolas, and from the many open-top units that are likely to be built for some time to come. Perhaps the dust collection equipment will always be considered accessory to the cupola, but not necessarily so if integrated with a heat recovery system. At least one existing scheme of heat recovery is built into the cupola shell.*

A study of the dust collection problem can be undertaken properly in two phases: the first dealing with possible accessory devices for addition to existing cupolas; the second dealing with the prospects of redesigning the cupola structurally for more effective integration of metallurgical control, thermal efficiency, and air pollution control.

In summary, we present Table 3 with our knowledge of some of the mass relationships occurring in the cupola process of melting iron. These are selected as the operating indices that have primary significance in the design and study of gas cleaning systems for the cupola.

It is anticipated that future work on this problem will be more productive than past efforts, and that important operating economies are in store for the foundry industry in exchange for the expense of dust control equipment. If work in this field can be sufficiently integrated in its effort, we should be able to create for the foundry without much delay both an indoor and outdoor atmosphere properly in step with the environment of other departments of progressive industry.

*Originated by W. D. Moore, American Cast Iron Pipe Co., Birmingham, Ala., this system does not divert the dirt-containing combustion gas into a heat exchanger (3).

Appendix

Estimating Gas Dilution Ratio from Stack Gas Oxygen Content

When studying the relation between the iron melting rate and the pounds of dust produced per hour, it is desirable to know the quantity and velocity of combustion gas in which the dust is suspended. Since this item is not always stated in reports of cupola performance, it may be necessary to estimate the quantity of combustion gas either from the quantity of blast air, if given, or from data reported for the gas issuing from the top of the stack. Unfortunately, it is not now general practice to report even the general magnitude of air volume induced through an open charging door, or to indicate whether the gas from the melting zone is burning above the stock line.

Nevertheless, one clue to a high order of combustion gas dilution is offered by the oxygen concentration in the stack gas, when reported. It is reasonable to assume that the oxygen content of the combustion gas from the melting zone is essentially zero, or at least negligible compared with normal air concentration. Accordingly, low oxygen percentage in the stack gas at the top of the cupola will indicate either (a) low order of dilution with air induced through the charging door, and no combustion at that point, or (b) high order of dilution accompanied by combustion of carbon monoxide remaining in the effluent gas from the melting zone. On the other hand, high oxygen concentration in the gas issuing from the stack during a period of normal melting indicates a high order of dilution of the combustion gas, even though part of the oxygen may have been consumed after entering the stack.

With the above limitations in mind, the gas dilution ratio can be expressed mathematically as a function of the oxygen depression caused by the combustion gas upon the air induced through the charging door, as follows:

$$\frac{\text{(oxygen in air by weight)}}{\text{(oxygen in air)} - \text{(oxygen in stack gas)}} =$$

$$\frac{G_s}{G_c} = \frac{0.23}{0.23 - O_2/G_s} = \frac{0.23}{\dfrac{\text{oxygen in air}}{\text{oxygen depression}}} = \frac{0.23}{\triangle O_2}$$

where G_s is effluent stack gas in pounds per hour; G_c is effluent combustion gas below the charging door in pounds per hour; $\triangle O_2$ is the "oxygen depression"; O_2/G_s is the weight-ratio of oxygen in the stack gas (approximately 1.1 times the volume-ratio); the oxygen in the gas from the combustion zone is assumed to be zero; and the induced air does not produce combustion between its point of inlet and the point of sampling.

If the carbon monoxide content of the discharged stack gas is very low or is zero, it indicates the probability of combustion between the charging door and the point of gas sampling; accordingly, the dilution of combustion gas with air is even higher than given by the above equation.

This equation is of interest not as an item deserving a place in a report of cupola stack gas analyses, but more properly as a warning that gas dilution ratio is an operating variable about which information should be given in any performance report for use by the dust collection engineer.

Special Symbols and Nomenclature

For Weight Units in Pounds Per Hour

The following symbols are suggested for uniformity in discussion of cupola dust collector design.

A_b = air blast into melting and combustion zone
A_i = air induced into stack through charging door (also known as "ventilation air")
C = carbon in coke charge
C_k = coke charged above bed-coke
D_i = dust or total solids in stack gas at inlet of cleaning equipment; ($D_i = D_o + D_d$)
D_o = dust at outlet of cleaning equipment
D_d = dust deposit from stack gas into cleaning device; total deposit of several cleaning stages
Fe = iron and steel charged as: pig iron, scrap, and returns from the foundry
G_c = effluent combustion gas below charging door; includes gasified carbon, CO_2 from limestone, and other gases and vapors
G_s = effluent stack gas at top of cupola, including dilution air entering charging door
L = liquid or water flow through collecting device (500 times gpm, for pounds per hour) $L = L_m + L_r$
L_e = water evaporation in gas washer; "evaporation loss" includes water droplets entrained by discharged gas
L_m = water make-up to cleaning circuit; $L_m = L_e + L_w$
L_r = water recirculated to cleaning device
L_w = water wasted from cleaning circuit
S_a = aggregate analysis of sulfur in iron and steel charged
S_g = sulfur content of stack gas, solid and gaseous
S_k = sulfur content of coke charged
S_s = sulfur content of slag
S_z = sulfur content of molten iron
W_s = waste or slag from cupola

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Bind in

SOURCES OF MOISTURE IN HOUSES

Present-day houses, tightly built and insulated, permit little interchange of air with the outside and cause much of the moisture generated within the house to be retained. This moisture causes condensation on cold outside surfaces and results in damage to textiles, wallpaper, and so on.

For these reasons it was felt desirable to study the sources, relative importance and methods of control of humidity in houses. The study was undertaken at Purdue University at the request of the American Gas Association Committee on Domestic Gas Research. The information which follows is abstracted from a report on this study issued by Purdue under the title "Research in Home Humidity Control."

The tests were conducted on an *average American family of four,* and the data apply to a family of this size.

SOURCES OF MOISTURE

FLOOR MOPPING. The water vapor produced by washing a floor is not nearly the largest source of vapor, but because of the amount and the short period of liberation it is the most important on a rate basis. To determine the water vapor generated by mopping floors, a kitchen floor was washed with soapy water and rinsed with clear water. On a unit area basis, the average value obtained was 0.03 pounds of water vapor released per one square foot of area washed and rinsed. This would amount to 2.40 pounds for an 8-foot by 10-foot kitchen.

CLOTHES DRYING. To evaluate the quantity of water vapor produced in washing and drying clothes, the articles soiled during a week by an average family of four were laundered in a standard-type washer. It was found that during the drying process alone 26.4 pounds of water vapor were released into the air. All tests were conducted according to commonly accepted procedures. In each run, times, temperatures, and methods were followed in an attempt to duplicate home-laundry conditions.

The clothes used in the first tests were next run in an automatic home laundry and removed and dried. Since this type of washer is completely enclosed and discharges directly to the drain, it was assumed that no water vapor was added to the air during the washing process. When the clothes were removed after spin drying, they still contained 26.7 pounds of water vapor that had to be removed by drying.

CLOTHES WASHING. The clothes mentioned above were washed in a standard-type washer and found to liberate 4.33 pounds of water vapor during the washing process alone. This value will vary according to the temperatures and amounts of water used in the washing process as well as the time of operation and quantity of water spilled. Since normal procedures were followed, the value given is a good average for this moisture factor. As stated before, the automatic type of home laundry is completely enclosed and adds no moisture to the home during the washing process.

COOKING. To determine the quantities of moisture released by cooking, a menu for a week's meals for an average family of four was prepared. An attempt was made in this menu to include only foods which might be prepared during the nine-months period from September to May inclusive, or, in other words, the winter months. The summer months were omitted because conditions of ventilation and outside temperature are less conducive to formation of condensation during this period.

In each test, weights, times, and gas consumptions were measured to obtain the amount of water vapor added to the air both from the combustion of the gas and the cooking itself. The average of a week's breakfasts gave off 0.9 pounds of water vapor, the average lunch 1.2 pounds, and the average dinner 2.7 pounds. About half this amount of moisture came from the cooking process and the balance from the products of combustion of the gas. The human contribution liberated during the cooking process (about 0.5 pounds per hour) is not included here. The meals were prepared in the manner an experienced housewife would employ, using average procedure as far as lids, oven, and serving are concerned. In oven cooking, an effort was made to employ what was considered to be normal oven usage, estimated to be 5.33 times per week.

Supplementary tests were conducted to determine the effect that the absence or presence of lids on cooking utensils had upon the water-vapor production. It was found that of the total moisture liberated by the food itself 12% to 100% more was released when the foods were cooked without lids. The quantity depended more upon the tightness of fit of the lid than upon the type of food cooked.

SOURCES OF MOISTURE IN HOUSES

Another experiment was run to evaluate the amount of water vapor generated during the serving and cooling of foods. The values for individual foods ranged from 2% to, in rare cases such as soup, 50% of the total moisture lost by the food alone in the combined cooking and serving process. The average for a meal was between 5% and 8%.

SHOWER BATHING. The data from the bathing experiments varied greatly with individual bathing habits, time required, temperature of water used, and size and construction of the bathroom. These variations must be considered when examining the results of the shower and bathing tests.

An average shower adds between ¼ and ½ pound of water vapor to the moisture content of a home. One of the difficulties of obtaining the total vapor produced in bathing tests, and especially in shower operation, is that condensation of water on cold surfaces such as windows and walls occurs soon after the operation is started, but much of this precipitated moisture may evaporate when the high-humidity air in the bathroom is allowed to mix with the air in the remainder of the house. As this process is taking place continually during the shower operation, the time that the shower is on is very important in obtaining the total moisture released. Another troublesome factor is the amount of water that drains off the shower curtain and walls and does not evaporate into the air.

TUB BATHING. Some of the difficulties encountered in obtaining data for shower bathing were met with in obtaining those for multiple bathing. From the tests to date it appears that the total moisture produced when four baths are taken consecutively is between ¼ and ½ pound. This means that one shower produces as much moisture as four tub baths.

DISH WASHING. The dishes and cooking utensils soiled during an average dinner for the family of four were washed and scalded to obtain the water vapor produced by this process. The amount released varied between ½ and ¾ pounds for the large evening meal, depending upon the temperature of the water used, the time elapsed, and the amount of utensils washed. Since fewer breakfast and lunch dishes are generally soiled than those used for dinner, 1 pound of water vapor per day is a suitable value for washing and drying dishes.

HUMAN CONTRIBUTION. One of the largest sources of water vapor in a home is that contributed by the inhabitants themselves through respiration and perspiration. This source, even though large (77 pounds per week), is not a serious contributor to condensation difficulties because it is a continuous source, and hence the rate is low, and it tends to raise the moisture level of the house but slightly.

To estimate the amount of water vapor added to the home through human contribution, an average figure of 11 pounds of water vapor per 24 hours was used, or 0.46 lb per hour. Figured on an hourly basis, this would be approximately 0.5 pounds per hour at night, when the entire family is in the house, and 0.46 pounds per hour during the day, when the husband is away and the others are more active. The exact amount generated depends upon body surface, quantity of heat production, amount of activity, and other variables encountered in day-to-day living.

TABLE 1—SUMMARY OF INDIVIDUAL SOURCES OF MOISTURE IN HOUSES
(Family of four)

Operation			Pounds of Vapor Produced per Operation
Floor mopping (per sq. ft.)			0.03
Clothes drying (per week, when drying is done indoors)			26.40
Clothes washing (per week)			4.33
Cooking	From food	From gas	
Breakfast	0.34	0.56	0.90
Lunch	0.51	0.66	1.17
Dinner	1.17	1.52	2.69
Bathing—shower			0.50
—tub			0.12
Dish washing			
Breakfast			0.20
Lunch			0.15
Dinner			0.65
Human contribution (per hour)			0.46
Gas refrigeration (per hour)			0.12
House plants (per hour)			0.04

Heat Transfer of Buried Pipe in Clay or Sand

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There has been considerable interest the last few years in developing a satisfactory ground heat source for the heat pump. Among those interested has been the Southeastern Electric Exchange who has sponsored a number of these studies from which the results in this article were obtained.

PRESENT knowledge does not permit the design of a generally accepted and economical buried pipe system for collection and dissipation of heat in heat pump installations. The amount of pipe needed costs too much or it cannot be conveniently laid on the average city lot. As a result there have been numerous suggestions on how the pipes may be made more effective. One of these is by using special fill materials to improve the heat transfer. Various tests have indicated that sand packed around the pipe might be advantageous in that it resists cracking and pulling away from a hot pipe. For this reason comparative tests were made on two identical loops of pipe, one buried in the regular red clay and the other surrounded by about 6 inches of sand before it was covered with the red clay.

The two buried pipes were each 88 ft long, 1⅛-inch in diameter and about 3 ft below the surface. Thermocouples provided temperature readings at various points on and around the two coils. An antifreeze solution of alcohol and water was circulated in the coils from a tank. A condensing unit controlled by a sensitive thermoswitch in the tank provided a stable temperature in the insulated tank. The solution was then pumped through a flow meter to the ground loops, one at a time for each test run, and the temperatures noted.

A test run consisted of bringing the tank temperature to a desired point and then circulating the solution continuously through one of the ground loops until the amount of heat absorbed or rejected and the temperature distribution in the ground became nearly constant. In the meantime the temperature drop through the coil was recorded and the rate of flow of solution was noted. Tests were run for solution temperatures of 80F, 90F, and 100F to test the heat rejecting characteristics and at 34F, 22F, and 16F to test the heat pick-up characteristics.

Typical temperature curves for heat dissipation and absorption are shown in Fig. 1 and 2, respectively. They indicate the temperatures in both directions horizontally from the pipes for various stages of two tests. The test shown by Fig. 1 was discontinued after 165 hours operation because it was reaching relatively stable conditions, while that of Fig. 2 was stopped after 151 hours. Both represent nearly a week's steady operation. Both would undoubtedly have gone to more steady conditions but it was not considered justified inasmuch as normal operation would be intermittent and allow for considerable recovery. Further, the results seemed adequate to draw the desired conclusions.

Fig. 3 shows the variation of heat transfer in Btu per hour per foot of pipe against hours of operation for the clay fill coil at a tank temperature setting of 100F. A rainfall of 0.72 inch caused the heat transfer to increase 13 Btu per (hr) (ft).

In order to get a true comparison of heat transfer between the two coils the heat transfer must be based on Btu per hour per foot per degree difference between pipe temperature and surrounding ground temperature measured at a point about 10 ft from the pipe before starting the test run. This value, called k, was calculated for each test. Results are presented in Fig. 4.

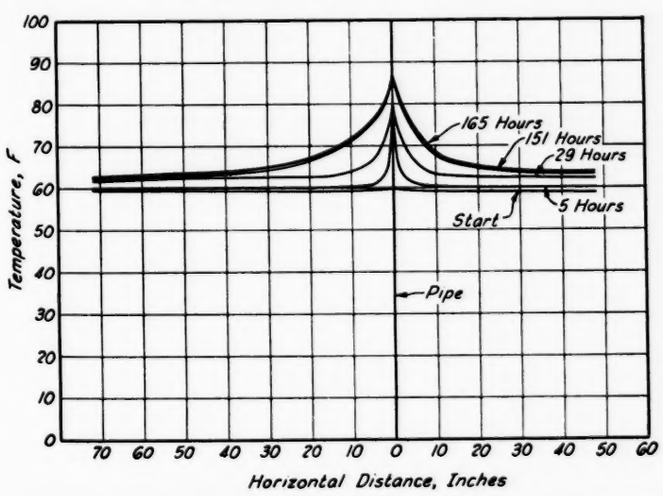


Fig. 1. Horizontal temperature gradient with fluid circulated at 90F; pipe in clay fill.

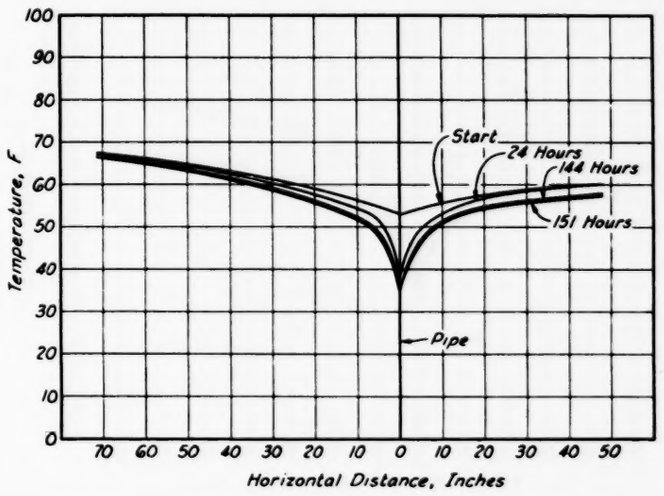


Fig. 2. Horizontal temperature gradient with fluid circulated at 34F; pipe in clay fill.

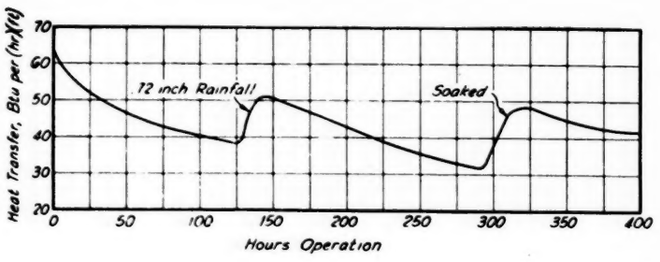


Fig. 3. Heat absorbed by earth per foot of pipe buried in clay fill with fluid at 100F

In Fig. 4 it is apparent that with the system operating on a cooling cycle (100F solution in the coil) the clay fill provides a slightly better heat sink than the sand fill. For the 90F and 80F test runs, not shown in the figure, the clay again was a better heat sink than the sand and values of k approximated those for the 100F cycle shown. The effect of soaking and rainfall is indicated for the clay fill.

The fact that the clay fill is a slightly better heat sink than the sand fill could be the result of moisture in the sand being driven away much faster than in the clay, and since moisture migration is a very influential factor in heat transfer, it could be the deciding difference between the two fills.

Heat transfer from the ground to the pipe during the heating cycle (34F, 22F, and 16F solution in the coil) is indicated by the higher curves in Fig. 4, and it appears that on the heating cycle the sand fill has a higher heat transfer than the clay fill. For the 16F temperature setting in Fig. 4, the difference in heat transfer becomes more pronounced with the sand being the better fill. This may have been caused by the presence of a greater amount of moisture in the sand fill and the subsequent freezing that could have occurred. Judging by the unusual shape of the curve on the sand fill, it appears that freezing was a consideration since the rate of heat transfer increased rather rapidly at first and then began to taper off.

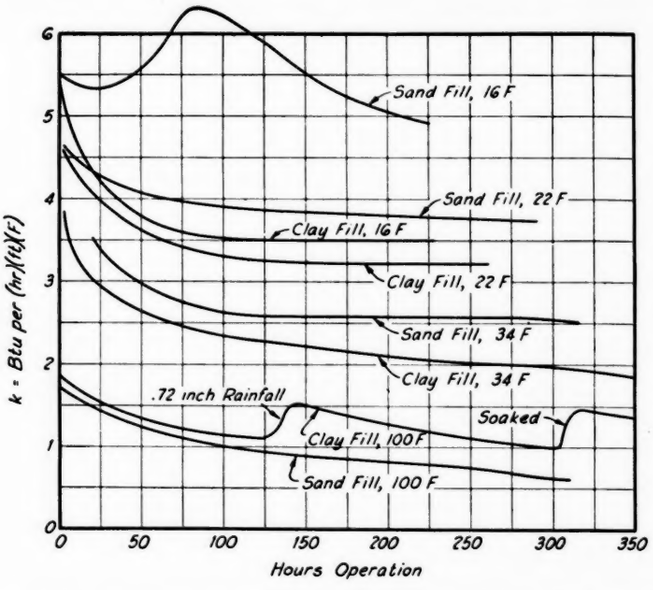


Fig. 4. Variation of earth k values for clay and sand fills at different temperatures of fluid in pipes.

Since for the heating cycle (heat absorption) sand appears to be the better fill, while for heat dissipation during the cooling cycle, the clay appears to have the edge, any choice between the two fills might be determined by the relative heating and cooling loads.

It should be emphasized that care must be exercised in extending these results to reach general conclusions for any other locality or for any other conditions. Other clays may act differently because of shrinking or by nature of their physical and chemical properties. However, it appears that sand promotes the migration of water to and from the buried pipe. Consequently, sand appears to give better transfer of heat than clay when heat is extracted and moisture tends to move toward the pipe. On the other hand, when heat is dissipated and moisture moves away from the pipe, the heat transfer in sand appears to drop slightly below that of the clay.

Insulation of Pipe Supports to Reduce Heat Losses

To prevent excessive heat losses due to direct metal-to-metal contact between hot pipe surfaces and structural supports, insulated supports, so-called, may be used. In this type of installation, developed by Sargent & Lundy, Engineers, from test work done at the University of Illinois, the entire length of piping is insulated in the usual manner and then supported by hangers or by channel irons.

Where the piping is to be supported by a hanger, a No. 10-gage steel plate, its length proportioned to the load to be carried, is rolled into a band to fit the insulated pipe and provided with a flange for assembly. A saddle plate, ⅜ inch thick, is then tack welded around the lower half of the flanged band, to assist in carrying the direct load and in spreading it over a wide area. The unit is then bolted in place around the insulated pipe, a filler bar is fitted over the upper half of the flanged band, and the usual hanger strap is fastened around the entire assembly.

Channel Supports

Where the pipe line is to be supported by channel irons, a 16-gage sheet metal band, 18 inches long and flanged for assembly, is bolted around the insulated pipe at each point of support.

Since the pipe rests on the insulation at the supports, the insulating material used must be able to bear the weight of the pipe. On the basis of the tests conducted at the University of Illinois, a loading capacity of 10 lb per sq in., or 100 lb per running inch of line, has been established for 85% magnesia.

Friction Loss in Sinuous Pipe Coils

WM. B. FOXHALL
Associate Editor, Heating and Ventilating

A simple method of calculating the actual length of pipe and frictional equivalent length in sinuous pipe coils.

THE friction loss in a sinuous pipe coil consisting of parallel runs of pipe joined by 180-degree bends is the sum of the friction of the actual length of the pipe plus the added friction due to bending.

If friction loss due to bending is expressed as equivalent additional length of pipe, total friction loss can be computed by merely substituting an adjusted value for length L in, for instance, the Fanning formula:

$$P = 0.322\ LFSV^2/d \qquad (1)$$

where

- P = friction loss, lb per sq in. in the coil
- L = length of pipe, ft
- F = a friction factor depending on the Reynolds number, N_r
  - F = .01 when N_r is less than 27,000 and greater than 140
  - F = .005 when N_r is greater than 27,000
- S = specific gravity (water = 1)
- V = velocity, feet per second
- d = actual inside pipe diameter, inches
- N_r = Reynolds number = m/zd
- m = weight of fluid flowing in lb, per hr, and
- z = viscosity of fluid, centipoises (water = .4 at 150F)

Actual Pipe Length

To determine the actual pipe length, L, in a sinuous coil, determine the spacing on centers, x, as shown in Fig. 1, the width of the coil tangent to bends, a, and the length of the coil over all runs, b, assuming that the panel begins and ends with 90-degree bends and that runs are joined by 180-degree bends.

The number of straight runs, N, will be b/x and the length of each straight run will be (a—x). The total actual length of *straight* pipe will be N(a—x).

The total actual length of pipe in the system will include this value of straight pipe to which must be added the length of pipe in each joining bend. Since the bends are 180-degree arcs of radius x/2 and they occur N times, the total actual length of *bent* pipe will be N(1.57x) and the total actual length of pipe in the panel will be

$$L = N(a - x) + N(1.57x)$$

or

$$L = N(a + .57x) \qquad (2)$$

where

- L = length of pipe, ft
- N = number of runs
- a = width of panel, ft
- x = pipe spacing, ft.

Where panels do not begin and end in 90-degree bends, it may be simpler to count the actual number of pipe runs. Any errors thus introduced into equation (2) will be negligible and can easily be adjusted by inspection. For heating calculations, of course, panel area would be b(a + x).

Pipe Bends

Contrary to popular belief, the friction loss in pipe bends does not diminish steadily as the radius of the bend increases. Tests have shown that bending a pipe on a radius of five pipe diameters will result in greater friction loss than bending on three diameters. The bend of least additional friction is on a radius of 2 to 3 pipe diameters; although, of course, for very long radii the bend approaches the limit of a straight pipe and the friction loss due to bending consequently diminishes in bends of radii above about 16 diameters.

In deriving the relationship of friction loss to bending radius, the radius of bending and the frictional equivalent length of the bend are expressed in pipe diameters because in these terms the variation of pressure drop with bending radius is, for practical purposes, the same in different pipe sizes. Thus the equivalent length in pipe diameters of, say, a two-inch pipe

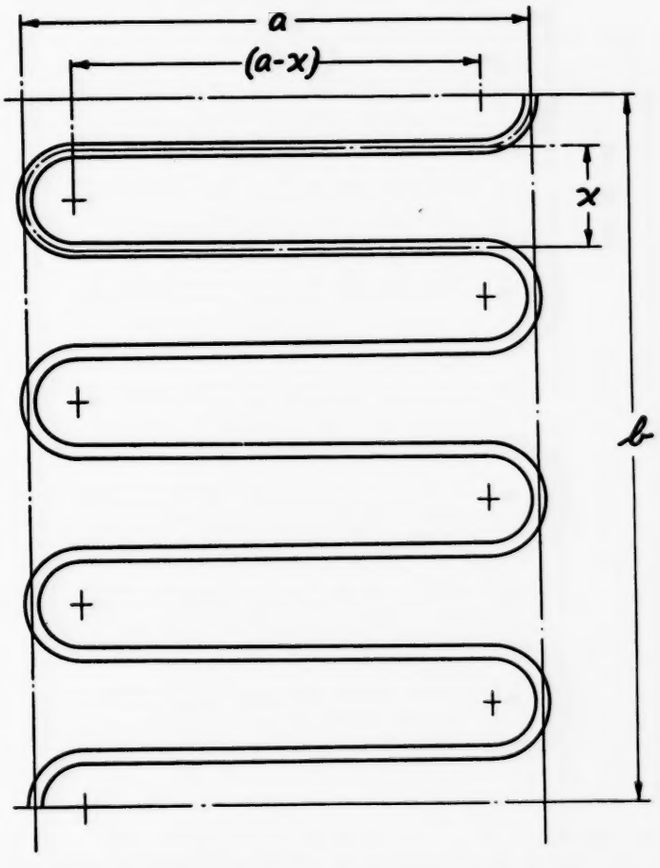


Fig. 1. Sinuous pipe coil of width a, length b, spacing on centers x, and actual length of pipe equal to (b/x)(a + .57x).

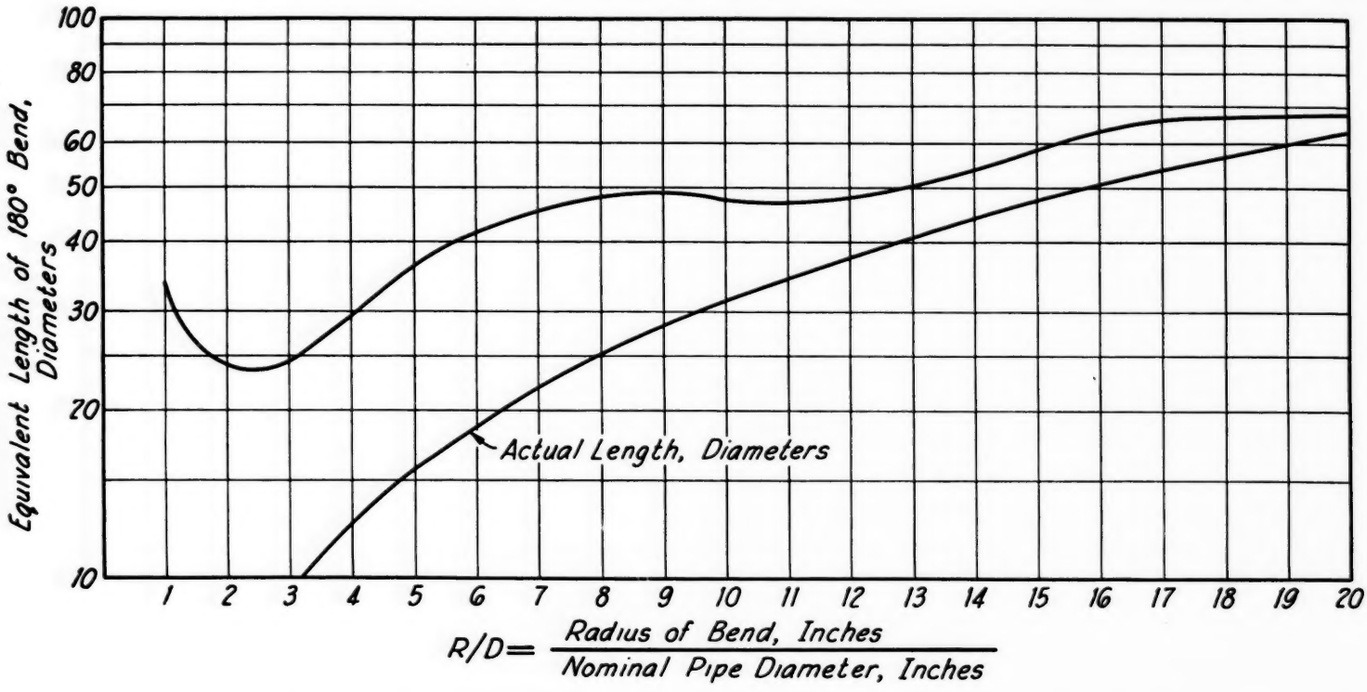

Equivalent Length of 180° Bend, Diameters
100
80
60
50
40
30
20
10
Actual Length, Diameters
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
R/D = Radius of Bend, Inches / Nominal Pipe Diameter, Inches

Fig. 2. Upper curve shows frictional equivalent length of 180-degree bends of pipe in nominal pipe diameters at various bending radii, also in nominal diameters. Values of frictional equivalent length include actual length (lower curve) plus increment due to bending.

bent on a 10-inch radius is practically the same as that of a one-inch pipe bent on a five-inch radius.

Fig. 2, based on Tube Turns and Crane values, shows how the equivalent length of 180-degree bends, expressed in pipe diameters, varies with the radius of bending also expressed in nominal pipe diameters.

Equivalent Length

The expression (1.57x) in the development of equation (2) represents the actual length in feet of a 180-degree bend on a radius of x/2 ft. For example, the actual length of a 180-degree bend in ¾-inch pipe on 8-inch centers would be 1.57 × 8/12, or 1.05 ft.

The radius of bending expressed in pipe diameters would be

$$\frac{R}{D} = \frac{4}{.75} = 5.33$$

where:

R = radius of bend, inches

D = nominal pipe diameter, inches.

The corresponding equivalent length, according to Fig. 2, would be 38.5 diameters, or 2.41 ft.

When the equivalent length, L_e, of this particular bend is expressed in terms of the pipe spacing on centers, it is found that

$$L_e = 3.59x$$

Since the equivalent length in diameters is constant for any given value of R/D, the ratio L_e/x is also a constant which may be substituted for the coefficient 1.57 in the bent pipe portion of the development of equation (2). The result is an expression for the frictional equivalent length of pipe in the coil:

$$L' = N(a - x) + N(Cx)$$

or

$$L' = N(a + yx) \qquad (3)$$

where L' = frictional equivalent length of pipe in sinuous coil, ft

$C = L_e/x$

$y = C - 1$

For the example given of ¾-inch pipe on 8-inch centers—and for any other case where R/D = 5.33—the coefficient $y = 2.59$ and

$$L' = N(a + 2.59x)$$

Similarly, for other values of R/D, corresponding values of y can be calculated with reference to Fig. 2. Values of y for various pipe sizes and spacings are shown in Table 1, which also shows equivalent lengths of various 180-degree bends.

Condition of Pipe

All the values shown are based on experiments with new steel, cast iron or corrosion-resisting pipe. For other types of pipe, Hazen-Williams gives a roughness multiplication factor k by which the pressure drop should be multiplied to insure accuracy for other types of pipe. See Table 2.

Example

Problem:—Calculate the pressure drop in an 8 by 10 ft panel of ¾-inch steel pipe on 10-inch centers carrying 4,750 lb of water per hr at 150F.

Data:—Viscosity of water at 150F is 0.4 centipoises; actual inside diameter of ¾-inch pipe is .824 inches; and 4.31 ft of pipe contain 1 lb of water.

Solution:—With reference to Fig. 1, $a = 8$; $b = 10$; $x = 10/12 = .833$; $N = 12$. To establish the

TABLE 1—FACTORS FOR CALCULATING FRICTIONAL EQUIVALENT LENGTH OF PIPE IN SINUOUS COIL

Nominal Pipe Size, Inches		Spacing on Centers, Inches																				
		4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
		Spacing on Centers, Feet (x in Equation[1] Below)																				
		.33	.42	.50	.58	.67	.75	.83	.92	1.00	1.08	1.17	1.25	1.33	1.42	1.50	1.58	1.67	1.75	1.83	1.92	2.00
		Actual Length of 180° Bend, Feet																				
		.53	.66	.79	.92	1.05	1.18	1.31	1.44	1.57	1.70	1.83	1.96	2.09	2.22	2.35	2.49	2.62	2.75	2.87	3.02	3.14
		Frictional Equivalent Length (L_e) of 180° Bend, Feet; and Friction Factor (y) in Equation[1] Below																				
½	$\frac{L_e}{y}$	1.23	1.52	1.74	1.94	1.98	2.05	1.98	1.98	2.02	2.08	2.25	2.44	2.64	2.78	2.79	2.80	2.80	.....	.....	.....	.....
		2.69	2.64	2.48	2.33	1.97	1.74	1.37	1.17	1.02	.92	.93	.95	.98	.96	.86	.76	.68	.....	.....	.....	.....
¾	$\frac{L_e}{y}$	1.50	1.59	1.84	2.12	2.41	2.60	2.78	2.86	2.97	3.06	3.05	2.97	2.96	2.97	3.03	3.08	3.20	3.38	3.56	3.75	3.94
		3.50	2.81	2.68	2.64	2.59	2.46	2.33	2.12	1.97	1.84	1.61	1.38	1.23	1.11	1.02	.94	.93	.96	.94	.95	.97
1	$\frac{L_e}{y}$	1.99	1.95	2.04	2.24	2.46	2.75	3.04	3.29	3.48	3.64	3.84	3.92	3.98	4.05	4.10	4.08	3.96	3.92	3.96	3.98	4.05
		4.97	3.67	3.08	2.86	2.67	2.66	2.62	2.58	2.48	2.37	2.28	2.14	1.98	1.86	1.74	1.56	1.37	1.24	1.16	1.08	1.02
1¼	$\frac{L_e}{y}$	2.65	2.49	2.44	2.50	2.65	2.84	3.08	3.35	3.65	3.94	4.16	4.34	4.50	4.68	4.82	4.90	4.95	5.05	5.10	5.10	5.03
		6.95	4.95	3.90	3.31	3.00	2.78	2.66	2.64	2.65	2.64	2.56	2.47	2.38	2.30	2.22	2.08	1.96	1.88	1.78	1.66	1.52
1½	$\frac{L_e}{y}$	3.44	3.18	2.99	2.94	2.95	3.06	3.25	3.43	3.68	3.98	4.25	4.56	4.81	5.00	5.18	5.36	5.55	5.75	5.87	5.90	5.94
		9.04	6.55	5.00	4.06	3.40	3.10	2.87	2.73	2.68	2.68	2.64	2.64	2.63	2.52	2.45	2.38	2.32	2.29	2.21	2.07	1.97
2	$\frac{L_e}{y}$	5.58	4.75	4.40	4.17	3.98	3.93	3.92	3.96	4.08	4.25	4.49	4.65	4.91	5.18	5.50	5.75	6.08	6.31	6.55	6.75	6.91
		15.9	10.3	7.80	6.20	4.95	4.25	3.66	3.30	3.08	2.94	2.84	2.72	2.69	2.64	2.66	2.62	2.64	2.61	2.58	2.52	2.46

[1]Equation for calculating frictional equivalent length of pipe in a sinuous coil is:

$$L' = N\,(a + yx)$$

Where: L' = Frictional equivalent length of pipe in coil, feet
N = Number of straight runs of pipe
a = Panel width tangent to bends at centerline of pipe, feet
y = Friction factor
x = Spacing on centers, feet.

friction factor F, Reynolds number is calculated as:

$$N_r = \frac{m}{zd} = \frac{4{,}750}{(.4)\ (.824)} = 14{,}411$$

where N_r = Reynolds number
m = 4,750 lb per hr
z = viscosity, centipoises
d = actual inside diameter, inches

Note that friction factor $F = .01$ is used since Reynolds number is greater than 140 and less than 27,000.

TABLE 2—ROUGHNESS FACTOR FOR CORRECTING PRESSURE LOSS CALCULATIONS

Type of Pipe	k
Smooth brass, copper or lead pipe	0.90
New steel, cast iron or corrosion-resisting pipe	1.00
Smooth wooden or concrete lined pipe	1.20
Old cast iron or new riveted steel pipe	1.40
Vitrified or old steel pipe	2.00
Old riveted steel pipe	2.50
Badly tuberculated pipe	2.50
General use (a good safety factor for ordinary use)	1.20*

*Where pipe may undergo a mechanical change caused by corrosion or deposit, k = 1.20 should be used. In hot water radiant heating, where water is not changed frequently, it is safe to use k = 1.00.

Frictional equivalent length of pipe will be, according to equation (3) and Table 1:

$$L' = N(a + yx)$$

$$L' = 12\ [8 + (2.33)\ (.833)\ ] = 119.2 \text{ ft.}$$

Velocity of water in feet per second will be

$$V = \frac{4.31 \times 4{,}750}{3{,}600} = 5.69 \text{ fps}$$

Substituting these values in equation (1), the pressure drop is found to be:

$$P = 0.322\ L'\ FSV^2/d$$

$$P = \frac{(0.322)\ (119.2)\ (.01)\ (1)\ (5.69)^2}{.824}$$

$$= 1.16 \text{ lb per sq in.}$$

For general use, this value would be multiplied by the factor k = 1.20, and the pressure drop would be 1.39 lb per sq in., or 3.21 ft of water.

Actual length of pipe in the coil will be

$$L = N(a + .57x)$$

$$L = 12[8 + (.57)\ (.833)\ ] = 101.64 \text{ ft.}$$

The Clyde L. Lyon elementary school, Glenview, Illinois.

Split System Heats School

Radiant floor slab is supplemented by convectors under windows. Trench around perimeter insulates the slab edge and serves as conduit for mechanical services.

AN unusual split system of heating, which assures maximum comfort for children in the classroom, is an outstanding feature of a newly-completed elementary school in Glenview, Illinois. The Clyde L. Lyon school has 10 classrooms, with its one-story construction allowing future expansion to 16 classrooms.

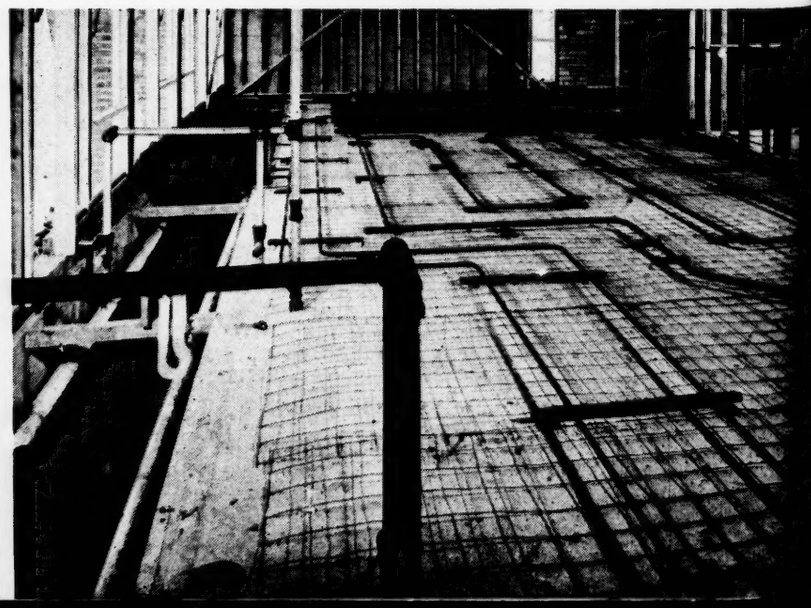
The heating system incorporates the best features of both radiant and convection heating. The system was developed by E. R. Gritschke, mechanical engineer of Chicago, in collaboration with Perkins & Will, architects-engineers, Chicago, who designed the school.

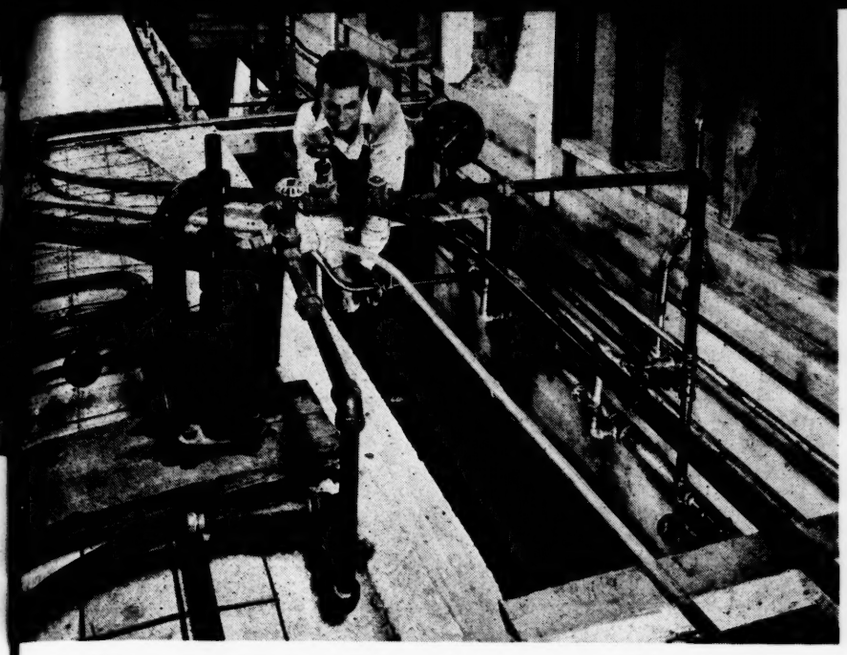
Convection heating carries the major share of the heating responsibility, while the floor panel radiant system insures against cold floors—one drawback of the preferred one-story type of schoolhouse construction. The floor panel, which responds to temperature changes relatively slowly, is controlled by outdoor thermostats, while interior thermostats control the more quickly responding convectors.

Heat losses around the edges of the floor slab are minimized by a perimeter trench running the length of all outer walls of the classrooms and enclosing piping for steam, water supply, waste and other mechanical equipment. Roofed over after installation, this tunnel becomes an effective barrier against moisture and cold and facilitates easy installation testing

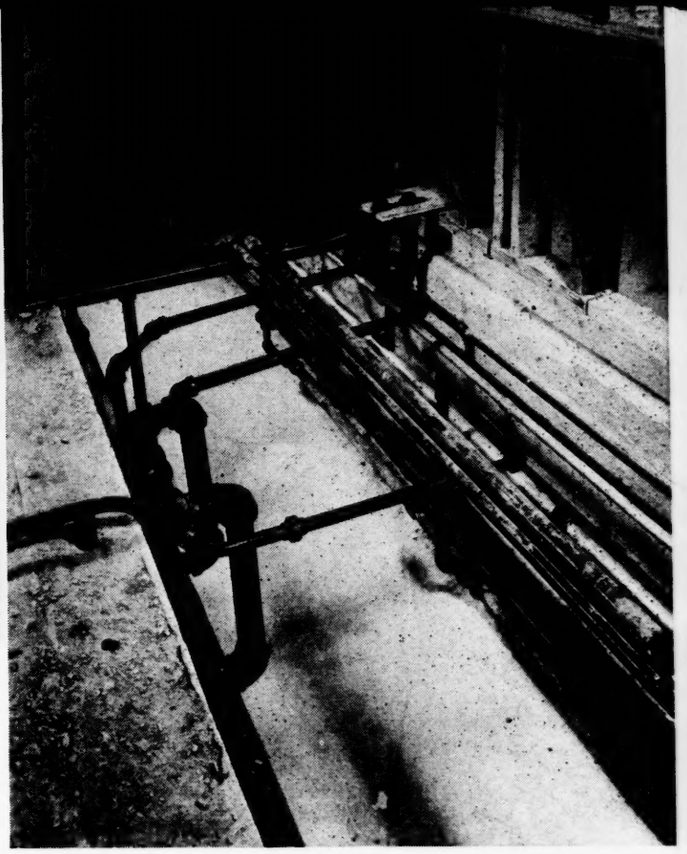
(Left) A perimeter tunnel houses mechanical supplies and serves as a barrier to heat losses at the slab edge.

(Below) Coil system, widely spaced in the coat rooms, is spaced more narrowly in the kindergarten (rear). With all piping in place and tested, tunnel is covered with Steeltex lath supported on reinforcing bars before concrete is poured.





(Above) Steamfitter completes installation of gage and pump for 200-lb hydrostatic test of completed floor coil.



(Right) Detail of tunnel showing passage under interior partition and grouping of service elements; electrical conduit at top of tunnel to be buried in a slab. Note support and sleeving of convector leads.

and maintenance of the mechanical supplies. This design contributed to a minimum installation cost for the radiant system.

The architects made the fullest possible use of color, sunlight and space in the design. Cheerful classroom illumination is gained through clerestory windows on the western exposure, and full glass windows, punctuated by closely-spaced jib walls, to the east.

Common facilities for school children during the day and for the adult community at night are concentrated in the central unit. This includes a cheery playroom with walls of glass and brick; a community lounge with a multitude of functions; the library, a health services room, the administrative suite, and, in the basement, a combined visual aids room and cafeteria.

Although the Clyde L. Lyon school was built during a period of peak building costs and materials shortages, its cost was average for the Chicago area. Total cost of the building, excluding architects' fees, was $367,924.00, or $12.43 per square foot.

Subcontractor on plumbing and heating was the Northern Plumbing & Heating Co., Chicago. Suppliers included: Pacific Steel Boiler (boilers); American Blower Co. (fans); Johnson Service Co. (temperature controls); Trane (fin convectors); Bell & Gossett (radiant floor panels); Todd Shipyards (oil burner); Kohler Co. (plumbing fixtures).

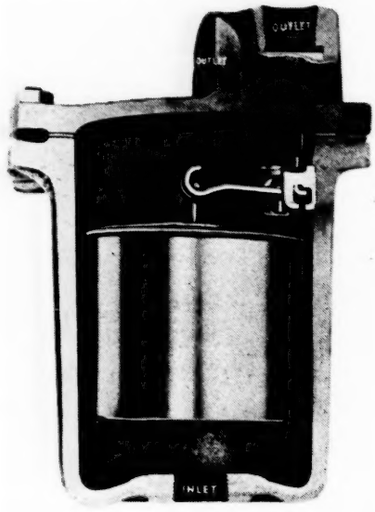
(Below) In the children's playroom, indoor comfort and outdoor beauty are gained through full-length windows forming the east wall, while convectors under windows create wall of warmth at point of greatest heat loss. Ceilings are of acoustical tile, floors of asphalt tile.

NEWS OF EQUIPMENT AND MATERIALS

Clark Steam Trap

NAME—Clark Duo-Step Leverage steam trap.

PURPOSE—Steam trap designed to use a special lever action for



greater ease in operation, and a larger orifice for greater drainage.

FEATURES—Trap uses a relatively short lever and two fulcrum points to distribute power and valve travel. The maximum leverage which is required to start the valve away from the orifice is obtained by using the first fulcrum point. Then a second fulcrum point automatically takes over, accelerates the length of travel and removes the ball valve away from the orifice. In this way, it is said, a larger orifice may be used and greater drainage capacity is obtained without increasing the length of the lever or the size of the trap. Trap is made of cast semi-steel, designed for pressures up to 250 lb per sq in., and temperatures up to 450F. All working parts are of stainless steel and the seats and discs are a special alloy that is highly resistant to wire drawing and cutting.

OPERATION—When trap is in a closed position, the gas-filled bucket is pushed up against the spindle and lever. Slow venting proceeds through the primary vent so that the bucket stays up for a long period on very low condensate loads. After enough gases are vented, the bucket loses its buoyancy and the bucket slides down on the spindle to fully open the secondary vent which has about 10.5 times the area of the primary vent. Remaining gases quickly vent out so that when the bucket strikes its travel limiting stop, it has attained full downward pulling power against the lever to open wide the trap discharge valve. By the time the bucket reaches the end of its downward travel the secondary vent is closed so that entering gases may fill the bucket to restore buoyancy, whereupon the bucket rises and closes the trap to complete the cycle.

SIZES AND CAPACITIES — Available for pipe sizes from ½ to 2 inches.

LITERATURE AVAILABLE—Folder.

MADE BY—*The Clark Manufacturing Co., 1830 E. 38th St., Cleveland 14, Ohio.*

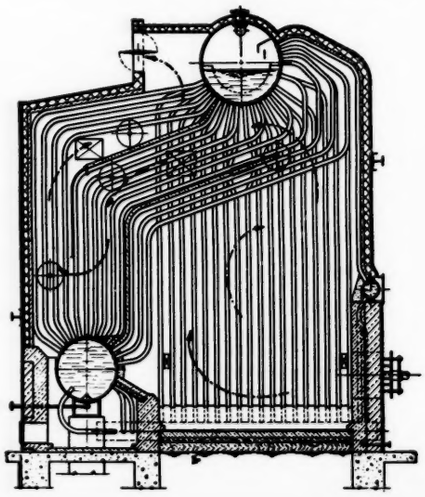
Item 435

Springfield Two-Drum Boiler

NAME—Springfield type C boiler.

PURPOSE—Standardized line of two-drum water tube boilers for steam generation.

FEATURES—Boilers feature a bent tube design that is compact and symmetrical. Gases enter the tube bank across the entire width of the furnace and this full width flow, it is claimed, is maintained throughout the entire unit. Temperature of gases at any particular section is said to be practically uniform across the entire width. Unit employs a water-cooled furnace design which has been found particularly effective for minimum furnace maintenance. In sizes up to 20,000



lb per hr and over, the furnace is completely water cooled, while below this size the design provides for side walls without water cooling. Superheater, air heater, and economizer can be furnished if desired. Firing equipment for coal, oil or gas, is available. To a large extent, dimensions of this line of boilers have been standardized and the capacity varies with the width of the furnace. Overall height and depth are the same for the standard sizes. Steam generating tubes located in the high temperature zone discharge above water level to assure dry steam and freedom from priming.

SIZES AND CAPACITIES — Available in capacities from 10,000 to 45,000 lb of steam per hr.

MADE BY — *Springfield Boiler Co., 1901 E. Capitol Ave., Springfield, Illinois.*

Item 436

Williamson Furnace

NAME—Williamson oil-fired, Flo-Warm hi-boy, No. 534-10B.

PURPOSE—Space heating.

FEATURES—Removable panels provide for access to filters, blower, motor, belt and bearings. Williamson - Lau blowers are standard equipment. Also standard is the Owens - Illinois Dust - Stop filters; use of an automatic drip humidifier is optional. A refractory combustion chamber is installed. The blower is operated by a ¼ hp, 60- to 110-volt motor provided with variable speed pulley and belt. The standard controls are Minneapolis-Honeywell with barometric draft regulator.

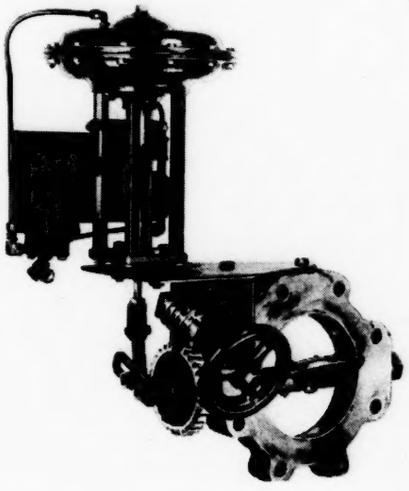
SIZES AND CAPACITIES — While at present produced with a maximum Btu output at the bonnet of 84,000, new sizes will be, 112,000, 151,200, and 196,000 Btu output.

MADE BY—*The Williamson Heater Co., Cincinnati 9, Ohio.*

Item 437

Rato-Vane Valve

NAME—Rato-Vane wafer-type air-operated butterfly valve.
PURPOSE—Process control.



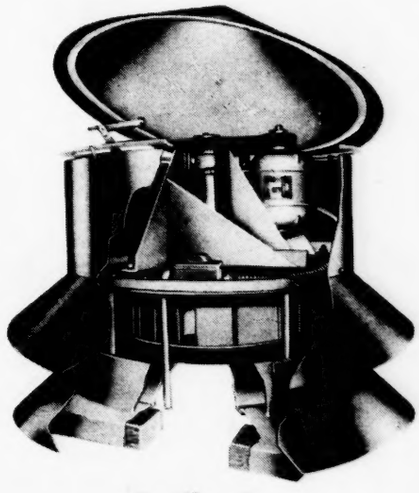
FEATURES—Valve is made in three standard materials — cast iron, bronze, type 304 and 316 stainless steel, and other materials, depending upon the type of corrosion resistance required. While a variety of drillings may be furnished, 125 lb flange drilling is standard. Valve body nests between two standard flanges by means of through bolts and contains standard flange facing surfaces. Only one set of flanged bolts is required for installation. Shaft material is of stainless steel. Bearings are of Micarta and require no external lubrication. The shaft extends through one side of the body for linkage with control mechanism. A deep packing box is used to prevent leaks. Unit contains a special sealing vane that is said to be clog-proof and which provides a tight shut-off. A sandwich of rubber on the face of the vane provides squeegee action on the valve as the valve approaches the closure point. This movement sweeps the seat clean of possible foreign material. Vane is secured in position on the shaft by a strong wedge plug at the center. Vane is available in the same type materials as the valve body. Unit is designed to handle static line pressures up to 125 lb per sq in., and differential pressures up to 50 lb per sq in. The standard butterfly valve is supplied with hand jack-screws, air operated diaphragms, and valve positioners.

SIZES AND CAPACITIES—Available in sizes from 3 through 12 inches.
LITERATURE AVAILABLE — Catalog No. 70.
MADE BY—*Fischer & Porter Co., Hatboro, Pa.*

Item 438

Gyra-Flo Exhauster

NAME—Gyra-Flo power exhauster.
PURPOSE—For ventilating schools, churches and similar types of buildings, where roof ventilation is possible.
FEATURES — Unit is designed so that, it is said, turbulence and discharge losses are reduced to a minimum. The complete inner structure framework is of heavy steel plate with rigid reinforcing. Wheel is of the backward curved type with steep pressure curves and nonloading power characteristics, and is balanced statically and dynamically for vibrationless operation. Made



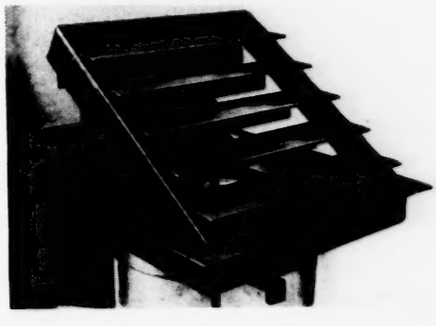
from one-piece heavy gage steel, the inlet cone is designed to keep turbulence and entrance losses at a minimum. The discharge cones, by utilizing the spin of the air imparted to it by the wheel, enable air discharged off the peripheral edge of the wheel to enter the surrounding atmosphere with a minimum of turbulence. Housing motor and fan wheel can be removed without disturbing the balance of the unit. Rubber vibration-eliminators are used to float the base. Motor is isolated from the exhausting air. Bearings and shafts are oversized to give a wide service factor margin. Unit is shipped fully assembled, complete with motor, drive assembly, frame, housing and safety switch.
LITERATURE AVAILABLE—Catalog.
MADE BY — *Chicago Blower Corp., 4558 W. Congress St., Chicago 24, Illinois.*

Item 439

Anemostat Turnotrol

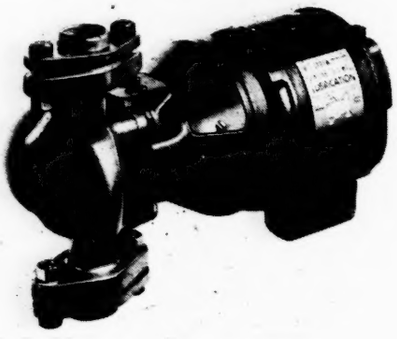
NAME—Turnotrol.
PURPOSE—Control device that combines the functions of a turning vane and a volume control for balancing heating, ventilating and air conditioning systems.
FEATURES—Unit consists of a series of turning vanes hinged to a frame which is attached to the underside of a special duct by sheet metal screws. An angle ring is used to which the take-off or diffuser is fastened. An adjusting or regulating rod which can be turned with a screwdriver, extends through the opening in the center cone of the air diffuser. In the fully closed position the vanes nest into each other and the leading edges of the turning vane form one straight line with no part protruding. This construction, it is said, prevents leakage and since the edges of the vanes that might cause noise are outside the duct air currents, a quiet installation results. Makers claim that this unit cuts pressure loss by as much as 50%. Unit can be used with any ceiling type Anemostat air diffuser and comes in a wide range of sizes.
LITERATURE AVAILABLE — Bulletin No. 30.
MADE BY—*Anemostat Corporation of America, 10 E. 39th St., New York 16, N. Y.*

Item 440



B&G Booster

NAME—B & G 75 booster.
PURPOSE — Circulating pump for small house heating systems.
FEATURES — Booster has ¾-inch



flange connections and employs two bolt flanges of forged steel. Booster is operated by a 1/15 hp motor which the manufacturer claims provides more gallons per horsepower than any circulating pump yet introduced. Unit is light in construction, simple to install, and quiet in operation. Booster is completely oil lubricated and the water-tight seal is precision ground for long service. Shaft is of hardened steel, ground and polished to a tolerance of 1/10,000 of an inch. Bearings are diamond bored and oversized for quiet operation and long life.
MADE BY—*Bell & Gossett Co., Morton Grove, Ill.*

Item 441

Hammel-Dahl Control Valve

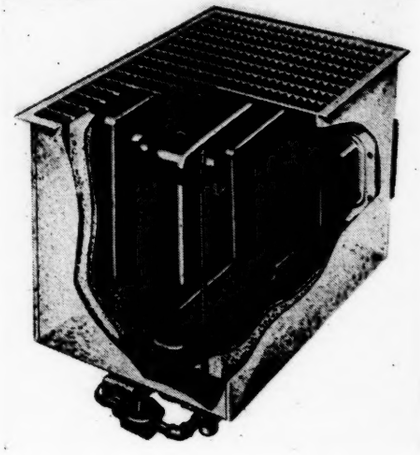
NAME—Hammel-Dahl continuously connected handwheel valve.
PURPOSE—Control valve which can be positioned by hand in event of air failure.

FEATURES—It is possible to position the valve plug by hand under any conditions by turning the handwheel to required position. The control valve characteristics are the same whether an automatic or hand control is used. Travel limit stops are part of the design and can be set to limit the valve stroke from zero to 100%. With this arrangement, when the valve is on automatic control, the handwheel is adjusted so that the valve can operate freely about the average plug position. Should there be failure of air to the controller, or the air line broken from the controller to the control valve, the control plug could only change its position plus or minus 12½%. In this emergency the operator could immediately position the valve plug to the proper position by turning the handwheel. The indicator, which shows the valve plug position and the setting of the travel stops, indicates at all times the per cent free travel of the valve plug and exactly in what portion of the valve stroke, the free travel can occur. It also indicates whether the handwheel is in a neutral position. Unit will function equally well in vertical or horizontal position.
MADE BY—*Hammel-Dahl Co., 243 Richmond St., Providence 3, R. I.*

Item 442

Lennox Floor Furnace

NAME—Lennox gas-fired floor furnace.
PURPOSE—Space heating.
FEATURES—The flat floor register model can be placed anywhere on the floor and is designed for single room heating. It can also be used for heating two or more rooms when placed in an archway. The heating unit is easy to remove for cleaning and servicing from inside the house. A Lennox burner is used with individually milled gas openings to assure a high air mixture with the burning gas. Burner is said to operate silently and to apply heat evenly to the heating surface. Steel body is welded. Special pilot equipped units shut furnace down in case of gas or pilot failure. Unit is suspended from the floor and the casing depth of 23 inches eliminates the need for building a pit. Shallow depth of furnace is also claimed to minimize hazards due to flooding and water seepage under the house. The die-formed heat exchanger and radiators are electrically welded into an airtight unit designed for high heat transfer. Products of combustion are fully exhausted outside the house.



Makers claim that expansion and contraction noise is eliminated due to the ribbing of body and radiator.
SIZES AND CAPACITIES—Flat grille model available in sizes from 32,500 to 60,000 Btu input. Also available are dual wall models at 45,000 and 60,000 Btu input.
LITERATURE AVAILABLE—Folder.
MADE BY—*Lennox Furnace Co., Marshalltown, Iowa.*

Item 443

EHW Rust Preventive

NAME—EHW formula.
PURPOSE — Protective coating for metal to prevent rust, corrosion, pitting and tarnish.
FEATURES—Compound provides, it is said, a tough, transparent and colorless coating that will withstand weather, heat, cold, grease and grit, but which can be removed with standard acetates. For outdoor applications one coat is considered to be a full year's protection; inside, coating is considered to have an indefinite life. Coating can be applied by brushing, spraying or dipping and dries in two minutes. In four to eight hours it reaches a hardness and adhesion that is said to equal baked enamel.
MADE BY—*Temperature Equipment Corp., 4505 Euclid Ave., Cleveland 3, Ohio.*

Item 444

Mor-Sun Gas Furnace

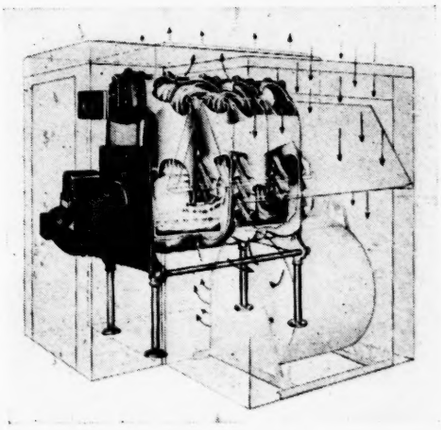
NAME—Mor-Sun gravity gas furnace.
PURPOSE—Warm air space heating.
FEATURES — Heat exchanger is heavy gage steel, die-stamped, and

welded. Gas burner is a single port, non-clog type, with a fixed orifice venturi tubular design to provide a semi-luminous full-floating convex flame. Furnace is fitted with a solenoid valve and safety pilot, a pressure regulator, main shut-off and pilot shut-off valves, thermostat and draft diverter. Furnace is said to be completely automatic. Unit meets the A.G.A. requirements that no part of the heating surface exceed 875F and no part should be less than 178F after 20 minutes of operation.
SIZES AND CAPACITIES — Model GR-2-G, input, 80,000 Btu per hr; output at bonnet, 60,000 Btu. Size of casing, width, 27 inches; length, 37 inches; height, 54 inches. Also available in a unit with an output of 82,500 Btu per hr.
MADE BY—*Morrison Steel Products, Inc., 601 Amherst St., Buffalo 7, N. Y.*

Item 445

Unique Furnace

NAME—Unique oil-burning furnace.
PURPOSE—Warm air space heating.
FEATURES — A sectional heat exchanger provides a longer path to obtain maximum heating effect from the hot flue gases. Depending upon the size of the furnace, heat exchanger is built of two, three or four sections. A special ferrous alloy is used which permits use of thin walls, resulting in a high rate of heat transfer. Unit has a refractory lined combustion chamber. Oil burner is easily removed from the front panel and all parts are readily accessible for servicing. An oil filter is supplied, to be installed below the burner pump. A Protectorelay, mounted in the unit in the path of the hot flue gases, controls the sequence of operations of the burner. A separate switch operates the blower according to air temperature inside the unit casing. A limit control in the blower switch shuts off the burner when the temperature rise is too high. A 13-inch blower, rated at 1,000 to 1,800 cfm and operated by a ¼ hp motor, is installed. Humidity is supplied by an automatic unit that is installed in the plenum chamber.
SIZES AND CAPACITIES—D-4 model, illustrated, has a capacity of 140,000 Btu output and measures 51 inches high, 33 inches wide, and 54 inches

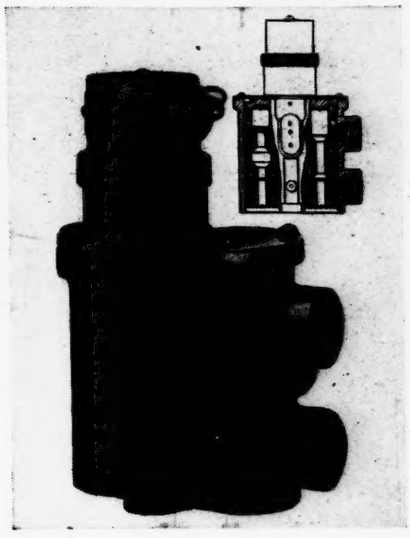


deep. Units of 84,000 and 112,000 Btu output also available.
LITERATURE AVAILABLE — Bulletin.
MADE BY—*The Excelsior Steel Furnace Co., 118 S. Clinton St., Chicago 6, Ill.*

Item 446

Crescent Valve

NAME—Crescent valve, model 1044.
PURPOSE—Four-way, pilot-operated, solenoid-controlled valve to handle air, water, or light oils.
FEATURES—Valve is said to be fast-acting and tight-seating and capable of operating continuously at any cycling speed up to 600 cycles per min. It is available for operation on line pressures from zero to

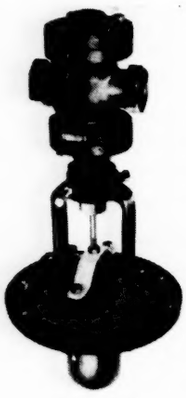


50 lb per sq in., and for line pressures from 30 to 150 lb per sq in. Two main valve members are disposed in vertical alignment with two parallel bores in the valve body. These members move up and down simultaneously to open and close respective inlet and exhaust ports. When one valve is open to "inlet" and closed to "exhaust" the other is closed to "inlet" and open to "exhaust," for there is no neutral open or closed position. With the solenoid de-energized, the valve members are biased upwardly by a combination of light stainless steel springs and fluid pressure. They move downward by pressure applied to the pistons on their upper ends when the solenoid is energized to actuate an integral 3-way pilot valve. Body is of cast bronze with screwed pipe connections tapped ¼, ⅜, ½ or ¾ inch I.P.S. Internal parts, including main valve members, are of brass. Main valve seats are of special composition rubber, molded to brass inserts. Pilot plunger and ball valve are of stainless steel. Either a-c or d-c solenoids are used. Power consumption is 21 watts a-c and 22 watts d-c.
LITERATURE AVAILABLE — Bulletin 1044.
MADE BY—*Crescent Valve Co., 6073 State St., Huntington Park, Calif.*

Item 447

Stabiflo Control Valve

NAME—Stabiflo control valve.
PURPOSE—Air-operated control valve to make possible quick reversible action.
FEATURES—By a simple operation, valve can be changed from "air to open" to "air to close," or vice versa, without removing the valve from its installation or without shutting down the controlled flow. The yoke is rigidly attached to the diaphragm motor housing and the valve stem moves integrally with the diaphragm plate when air pressure is applied. The stem is attached to the diaphragm plate by a strap bolted to lugs projecting from the plate. To reverse the action it is only necessary to unbolt the diaphragm motor, rotate it 90 deg and then replace the bolts. The mounting lugs on the diaphragm motor housing, originally bolted to the yoke, are now bolted to the valve stem strap and the lugs on the diaphragm plate bolt to the yoke. When the air pressure is exerted to flex the diaphragm, the motor housing is lifted, carrying the valve stem with it. The maximum upward motion of the motor housing is equivalent to the full stroke of the valve. This design is now standard for the company's Stabiflo valves in the most common sizes.

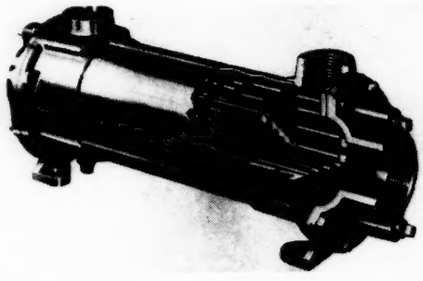


LITERATURE AVAILABLE — Bulletin 2268.
MADE BY—*The Foxboro Company, Foxboro, Mass.*

Item 448

Stainless Steel Exchanger

NAME—Ross all-stainless steel heat exchanger, type SSCF.
PURPOSE—An acid and corrosion resistant type heat exchanger for the chemical and process industries where copper, copper alloys or other metals might prove detrimental.
FEATURES — While type 316 stainless steel is regularly furnished with this exchanger because of its almost universal acceptance in industry, other types of stainless steel can be supplied on special order. Before leaving the factory each unit is tested at 450 lb per sq in.; tubes at 300 lb per sq in. Interchangeable replacement parts are available on short notice. For installations where standard designs are not feasible, specially engineered units can be assembled from regular standard parts. Makers claim that closest possible tolerances between shell and baffles and tubes and baffles prevent bypassing of fluid. This, combined with the transverse baffling, it is claimed, assures best possible heat transfer rate. The company's method of roller expanding tubes into tube sheet holes is said to provide leak-proof service.
SIZES AND CAPACITIES—Available in single, two-pass and four-pass units in lengths from 11 to 79 inches and



diameters from 2⅛ to 8⅛ inches.
LITERATURE AVAILABLE — Bulletin 1.7K1.
MADE BY—*Ross Heater & Mfg. Co., Inc., Division of American Radiator & Standard Sanitary Corp., 1407 West Ave., Buffalo 13, N. Y.*

Item 449

Aluminum-On-Steel Sheets

NAME — Reynolds aluminum-on-steel sheet metal.
PURPOSE — An aluminum-on-steel combination to provide a coating to protect the steel against corrosion.
FEATURES—Strips of aluminum foil are applied to the top and bottom of the steel sheet. A fine iron coating is applied to the steel first by an electrolytic process to provide a permanent bond between the steel and aluminum surfaces. Application of this coating in a single continuous process involves passing steel strip from a coil through a cleansing bath, an electrolytic bath where it receives the iron coating, a furnace to heat it to about 805F, and then a step to bond strips of aluminum foil to the steel sheet by high pressure rolling.
MADE BY — *Reynolds Metals Co., Richmond, Va.*

Item 450

Slant-Fin Radiator

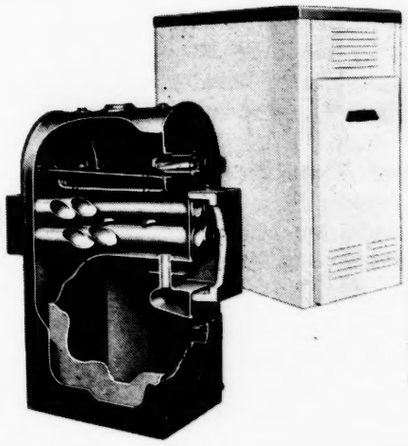
NAME—Slant-fin radiator.
PURPOSE—Space heating.
FEATURES—Radiation is provided by specially designed fins that are secured to the pipe and yet can be removed without tools should it be necessary. This simplifies any threading or welding of pipe at any particular point in the pipe line. While the slant-fins are no wider than conventional plate-type fins, larger radiating area is provided plus, it is said, a longer line of contact with the pipe. Finned type is supported by special brackets that are placed no more than four feet apart. A protective grille cover is available.
SIZES AND CAPACITIES—At standard conditions of 1 lb steam pressure

and 70F entering air, rating is 1,020 Btu per hr per lineal foot, or 4¼ sq ft radiation per lineal foot.
LITERATURE AVAILABLE—Illustrated folder.
MADE BY—*Slant-Fin Radiator Corp., 2836 W. 15th St., Brooklyn, N. Y.*

Item 451

Wayne Boiler

NAME—Wayne steel heating boiler, series WA.
PURPOSE — Steel boiler for space heating, to be operated with either oil or gas burner.

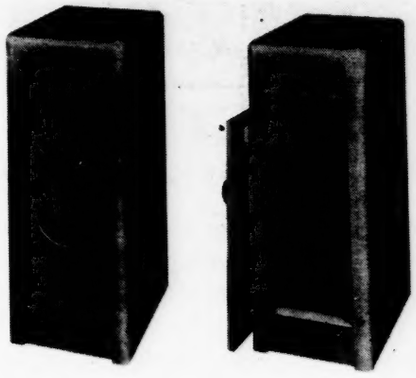


FEATURES—Unit has extra long flue passes, large furnace volume and low water line to assure efficient heat transfer. Heat loss is minimized by heavily insulated fire and flue doors. Domestic hot water coils are arranged to permit free boiler water circulation for rapid heat transfer. There are 4 to 14 3-inch tubes in each pass, depending on size of boiler, to provide large exchanger surfaces. Tubes are expanded and flared to 5/16-inch tube sheets to provide durable joints. Heavy stay-bolting between 5/16-inch wrapper sheets and firebox are electric welded. Both the internal tube and firebox surfaces are easily accessible. The domestic hot water coil provides from 200 to 600 gal per hr of hot water, depending on boiler size. Both oil and gas burners are available. Special burners for gas firing are supplied for use with all types of gas.
LITERATURE AVAILABLE — Bulletin.
MADE BY — *Wayne Home Equipment Co., Inc., Ft. Wayne, Ind.*

Item 452

Sphinx Rubbish Burner

NAME—Sphinx wasteburner.
PURPOSE—Incinerator for burnable household refuse and dry garbage.
FEATURES—Unit acts as an auxiliary space heater for the basement, in addition to being used for the disposal of shop waste. Casing, which is insulated with aluminum foil, has a rear flue outlet and an open grille top. Firebox is constructed of 14-gage steel and has a capacity of one bushel. A shaker grate and a large capacity ash pan are provided. Primary and secondary air adjustments in the casing permit the user to dial the correct setting for odorless and smokeless operation. The inner door opens and closes automatically with the outer door. Makers claim that the burning of a day's collection is sufficient to help heat the basement in which the unit is installed.
SIZES AND CAPACITIES—20½ inches



deep, 14 inches wide, 34½ inches high.
MADE BY—*C. L. Bryant Corp., 4610 St. Clair Ave., Cleveland 3, Ohio.*

Item 453

Kenlin Combustion Indicator

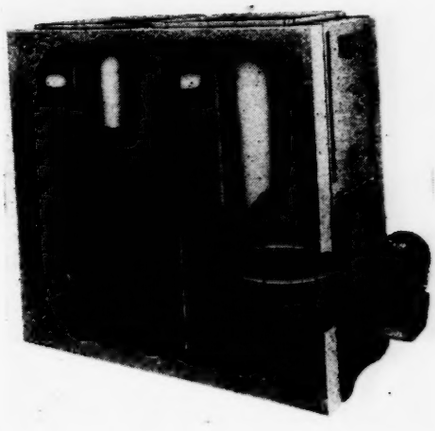
NAME—Kenlin combustion indicator, model KSD-1.
PURPOSE — Instrument to measure flue gases in boiler installations.
FEATURES—Instrument is designed to respond to deviations from the desired haze in combustion smoke. Indications can be fast or sluggish, depending upon type of response required. Instrument consists of three units—a light source; a photo amplifier; and an indicator for the panel board. Stack unit housings are of aluminum castings and are gasketed to seal the instrument from boiler room conditions. The mounting collar has a 2½-inch pipe thread so that connection to the breeching proper can be made easily with a close nipple and flange. Flange may be bolted or welded to the breeching. Indicator box is constructed of heavy gage welded steel and is available with either surface or flush type mounting. Outer panel has two signal lamps and an indicating meter with an arbitrary scale of 100-0-100. With this scale, instrument is set at zero when combustion is correct. Audible alarms can also be operated in conjunction with the signal lamps. A current indicator on the stack unit simplifies adjustment. The standard instrument operates from 110 volt, 60 cycle power.
MADE BY—*Kenlin Instruments, 1-3 S. Maple Ave., East Orange, N. J.*

Item 454

Thatcher Furnace

NAME—Thatcher 492 series winter air conditioner.
PURPOSE—Space heating.
FEATURES—Unit has a large heavy gage welded body and economizer. The tailor-made burned refractory combustion chamber is pre-fired for added life. Furnace has 20 by 25-inch replaceable air filters. The blower is resiliently mounted for quiet operation. It has an adjustable motor pulley for more flexible operation, and has sleeve bearings. The burner and nozzle of the flange-mounted oil burner are locked in correct relationship to the combustion chamber for perfect alignment.
SIZES AND CAPACITIES—63,000 and 80,000 Btu at the register.
LITERATURE AVAILABLE—Bulletin.
MADE BY — *Thatcher Furnace Co., Garwood, N. J.*

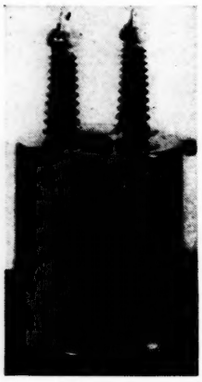
Item 455



Westinghouse Transformer

NAME—Westinghouse precipitation transformer.

PURPOSE—Special transformer designed to provide a source of high voltage for electrostatic precipitation.



FEATURES—Transformer is oil-insulated and hermetically sealed. All major gaskets are eliminated by the use of welding or soldering. Low-voltage bushings are in a well set into the top of the tank and hermetically sealed from the transformer itself. Conduit connection to the junction box is carried under the top and through the side wall. Radio interference is kept at a low level through the use of improved high-voltage bushings treated at critical points with a semi-conducting glaze. High strength against surges is obtained by shielding the design of the core and coils and static plates and rings.

SIZES AND CAPACITIES—Available in 5, 7.5, 10, 15 and 25 kva sizes for 60,000 to 75,000-volt operation at 60 cycles. Other transformers in the same ratings are available for operation at 25 cycles.

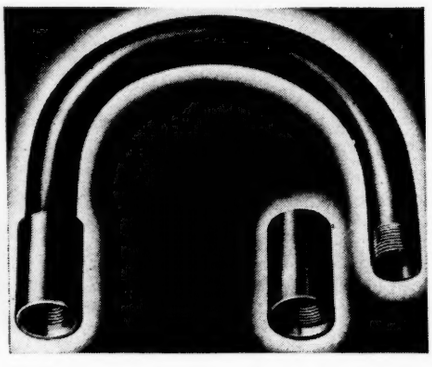
MADE BY — *Westinghouse Electric Corp., East Pittsburgh, Pa.*

Item 456

Redi-Bend

NAME—Redi-Bend.

PURPOSE—A complete line of pipe fittings for use with wrought iron and steel radiant heat installations.



FEATURES—The weld-type bend, for welding applications, has upset ends as an integral part of the unit and requires only two welds to connect the bend to the pipe. The coupled type, threaded, is supplied with two extra heavy recessed, taper tapped couplings, to withstand 300 lb steam pressure. The sleeve-type bend is similar to the other two except that it is made with plain ends. Two welding sleeves are furnished with each sleeve-type bend. Bends are available in 180, 90, and 45 deg, and either long or short types.

SIZES AND CAPACITIES—Available in pipe sizes of ½, ¾, 1, 1¼, 1½ and 2 inches.

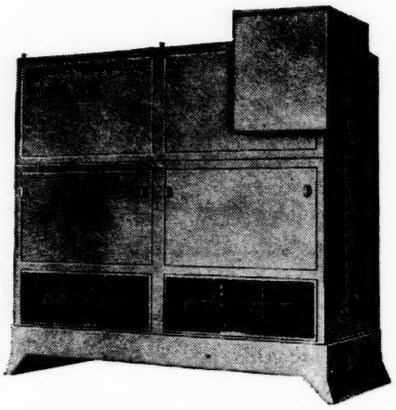
MADE BY — *The Capitol Manufacturing & Supply Co., 153 W. Fulton St., Columbus 16, Ohio.*

Item 457

Kennard Cooling Tower

NAME—Kennard induced draft cooling tower.

PURPOSE—Cooling condensing water for air conditioning installations and for industrial applications.



FEATURES—Cooling towers are designed to withstand constant exposure to the elements. Simple provisions for winter protection can be inexpensively provided by means of the remote inside pump and automatic drain back water sump. The standard unit is supplied with vertical discharge, although a horizontal discharge can be obtained if desired. Smaller sizes are made in vertical discharge only. Fan motor mount is mounted on an adjustable pivot base in optional positions external to the unit. Oiling, servicing, and belt or speed adjustments are thus simplified. Bearings are self-aligning cast iron pillow block type with graphite bronze bushing. The sump pan provides not only the necessary base of the unit but its welded, galvanized corrosion protection is said to insure long life. Pan is made of No. 10- to 14-gage steel. The eliminator-blade assembly is made of 24-gage galvanized steel Z formed blades riveted to die-punched and formed U-channel end-frames.

SIZES AND CAPACITIES—Horsepower of motor from ¼ to 10 hp; capacity of tower 3-75 tons.

LITERATURE AVAILABLE — Bulletin No. 494.

MADE BY — *Kennard Corporation, 1819 S. Hanley Rd., St. Louis 17, Mo.*

Item 458

Sola Transformer

NAME—Sola power transformer, type CFE.

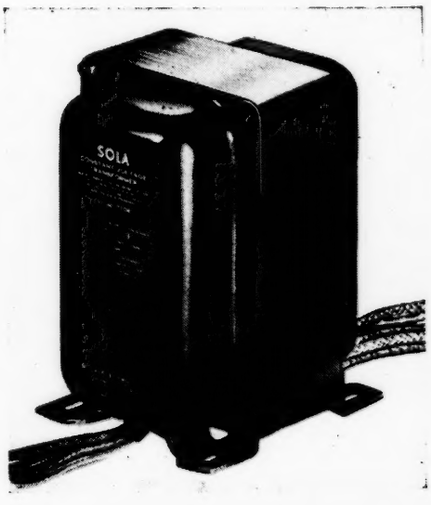
PURPOSE — Transformer to correct line voltage and for precision voltage regulation for electronic uses.

FEATURES — Transformer provides high voltage plate and filament windings on the same core, all of which are voltage-regulated to within plus or minus 3%. Unit corrects line voltage variations of 100 to 130 volts at plus or minus 3% or less at its outputs. Three models will be available.

LITERATURE AVAILABLE — Bulletin P-45 CVE 138.

MADE BY—*Sola Electric Co., 4633 W. 16th St., Chicago 50, Ill.*

Item 459

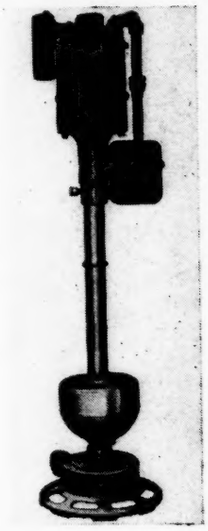


Penberthy Sump Pump

NAME — Penberthy sump pump, series MC.

PURPOSE—Sump pump for use in hazardous locations and explosive atmospheres.

FEATURES—Motor leads are connected to switch terminals through threaded conduit. The switch housing has ½-inch pipe size threaded outlet for connection to line. The motor and switch are totally enclosed and are explosion-proof. Since unit is constructed of copper and bronze throughout, it cannot rust. Switch is controlled by a heavy copper float which slides freely on its supporting column. An adjustable stop governs the water level at which the pump starts and stops. Motor operates on 110-volt, 60-cycle, or 220-volt, 60-cycle current.



SIZES AND CAPACITIES—Pump can operate against a 23-ft discharge head. Available in five sump depths of 2, 3, 4, 6 and 8 ft.

MADE BY—*Penberthy Injector Co., 1242 Holden Ave., Detroit 2, Mich.*

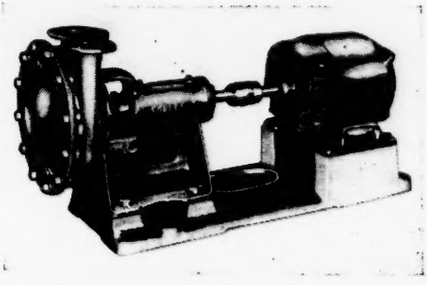
Item 460

Goulds Pump

NAME—Goulds stainless steel centrifugal pump.

PURPOSE — Pump designed for the process industries where materials to be handled might be corrosive to pumps of other models.

FEATURES—Units in stock are made of either No. 316 or FA 20 stainless steel. All stainless steel castings are fully annealed. Stuffing-box is located on the suction side of the impeller. Pressure on the box is therefore limited to the suction head or pressure under which the pump operates. Both suction and discharge connections are located in the casing. By removing the casing cover, one is able to reach the interior of the pump for inspection or for servicing. Impeller may be removed or replaced without disturbing the piping. Provision is made for adjusting the clearance between the impeller vanes and the casing to take care of wear.



SIZES AND CAPACITIES — Available in eight sizes with capacities up to 750 gpm and heads up to 180 ft.

LITERATURE AVAILABLE — Bulletin 725.

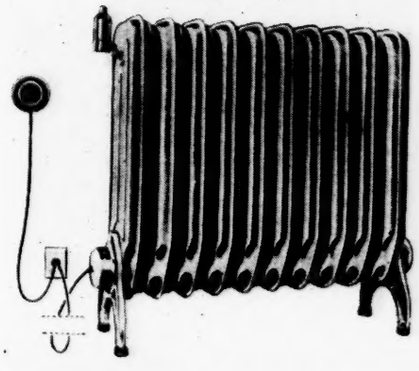
MADE BY — *Goulds Pumps, Inc., Seneca Falls, N. Y.*

Item 461

Electric Radiators

NAME—Electresteem portable electric steam radiators.

PURPOSE—Portable electrically operated unit for space heating.



FEATURES—Unit has a dual steam heating device that provides turbulent steam plus forced steam through pressure jets in each section of the radiator. Radiators operate at 110 to 120 volt a-c or d-c, while special voltages may be obtained on request. A remote extra thermostat control is available at added cost. This thermostat is placed as far as 12 feet from the radiator to provide satisfactory controlled operation.

SIZES AND CAPACITIES—The 6-section unit consumes 790 watts and has an output of 2,400 Btu per hr. The 8-section unit consumes 900 watts and has an output of 3,200 Btu per hr. The 10-section unit consumes 1,110 watts and has an output of 4,400 Btu per hr.

MADE BY—*Electric Steam Radiator Corp., 1 Electric Ave., Paris, Ky.*

Item 462

Airtemp Conversion Burner

NAME—Airtemp conversion burner.

PURPOSE — Conversion-type burner with a wide range of oil-burning capacity through use of special heads.

FEATURES—Wide range of oil-burning capacity of this unit is obtained by the use of four interchangeable heads—No. 1 with capacity from ½ to 1 gal per hr; No. 2, 1.25 to 1.35 gal per hr; No. 3, 1.5 to 2 gal per hr; and No. 4, 2.25 to 4 gal. As a result of this design makers claim dealers will be able to stock one oil burner that can be adapted to many jobs. The integral relay, which is mounted on the burner, is factory wired. Burner is operated by a ⅛ hp motor. The low voltage combustion control operates on a Class 2 circuit, thereby eliminating a conduit that would be required for power supply. Controls on the burner include a factory wired mounted primary and low voltage stack unit.

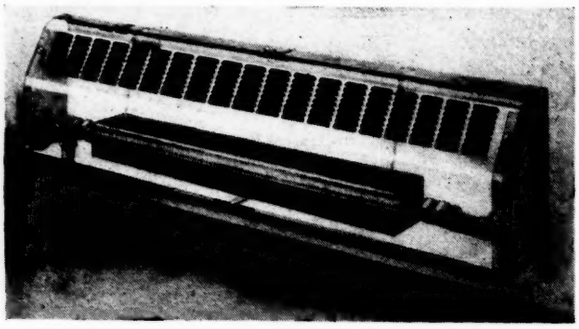
MADE BY — *Chrysler Corporation, Airtemp Div., Dayton 1, Ohio.*

Item 463

Webster Convector

NAME—Webster Walvector.

PURPOSE—Convector type enclosure with a fin type heating element for



steam or hot water heating systems.

FEATURES—Essentially this unit is an elongated non-ferrous convector designed for mounting along the wall close to the floor line or along the windows. The flexible design permits its use either as a separate convector unit or for wall-to-wall application. The unit comes as a complete package incorporating all the necessary components. Each package includes a Webster type WI heating element, mounting angle, enclosure, enclosure end plates, enclosure trim pieces, lower braces and heating element hangers. A sponge rubber gasket seals the space between the enclosure and the wall, providing a tight air seal, particularly if there are wall irregularities. This feature, together with the flat 2-inch horizontal surface and the slope front with directional louvers divert the flow of heated air from the wall. Unit may be placed at any desired wall height and makes no demand on floor space.

SIZES AND CAPACITIES—Available in three types—single row for 3-inch fin in an 11-inch high enclosure has a basic steam radiation of 5.9 sq ft EDR per lineal foot of heating element. Single row 4-inch fin in a 12½-inch high enclosure has a basic steam rating of 9.7 sq ft EDR per foot. The double row model for the 4-inch size in a 20-inch high enclosure has a basic steam rating of 11.35 sq ft EDR per foot.

LITERATURE AVAILABLE — Bulletin B-1551.

MADE BY—*Warren Webster & Co., Camden 5, N. J.*

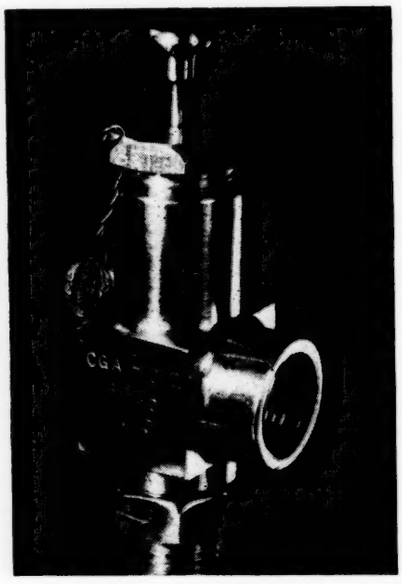
Item 464

Refrigerant Relief Valve

NAME—B.S.&B. refrigerant relief valve, model CGA ½-2.

PURPOSE—Relief valve to consistently seat tightly, thereby minimizing loss of refrigerant.

FEATURES—A rupture disc is placed on the outlet of the relief valve so that it may be renewed, when necessary, while the relief valve temporarily holds the gas in the system with only a small loss of refrigerant. Use of rupture disc is favored where dirt may lodge under valve and where a large quantity of refrigerant is used. However, valve can be used without safety head. Makers claim that this valve is an extremely tight seating valve which, under clean conditions, will hold the Freon gas without leaking even after the valve has had many poppings. Valve is constructed of brass with the exception of polished stain-



less steel piston and stem. Synthetic rubber seals are used with this valve. Inlet connections are either ¼, ⅜, or ½ inch, and the outlet is ½ inch. Valve was tested and accepted by the ASME. Unit has seated properly after exhaustive field and factory tests.

MADE BY—*Black, Sivalls & Bryson, Inc., 106 W. 14th St., Kansas City 6, Mo.*

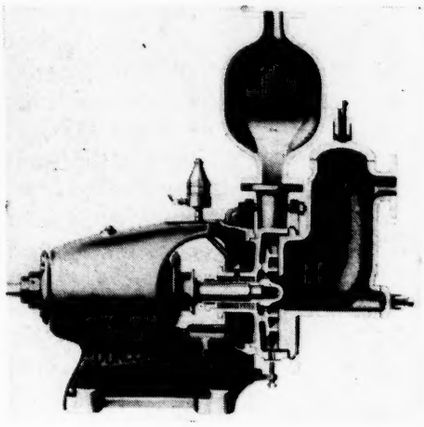
Item 465

Duriron Pump

NAME—Durcopump, model 40, series R.

PURPOSE — Self-priming, corrosion resisting pump for handling corrosive solutions and fluids.

FEATURES—When the pump is started water is thrown into the air



separator and at the same time air is drawn in from the suction line at the eye of the impeller. Water and air pass into the air separator. When air in the suction line is evacuated, the impeller discharges fluid through both its ports. Pump has a mechanical drive of the same construction as the model 40 unit. Major parts are interchangeable. The wet end of the pump is available in a wide variety of Durco alloys, as well as monel, nickel, iconel, niresist, nickel cast iron, and cast steel. Conversion of wet end parts from one alloy to another can be made without changing working dimensions or the power end. Teflon seal cages in stuffing-box are used for lubricant or liquid seal. Corrosion resisting deflectors are used to protect bearing construction in the power end.

LITERATURE AVAILABLE — Bulletin 816.

SIZES AND CAPACITIES — Available in two sizes, one with capacity ranging from 20 gpm against 81 ft TDH to 160 gpm against 33 ft TDH; the other has a capacity from 40 gpm against 125 ft TDH to 240 gpm against 75 ft TDH, when functioning at operating speeds of 1,750 rpm.

MADE BY—*The Duriron Co., Inc., Dayton 1, Ohio.*

Item 466

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946, OF HEATING AND VENTILATING, published monthly at New York, N. Y., for October 1, 1949.

State of New York,

County of New York, ss:

Before me, a Notary Public in and for the State and county aforesaid, personally appeared Edgar A. Becker, who, having been duly sworn according to law, deposes and says that he is the Treasurer of the Industrial Press, Publishers of HEATING AND VENTILATING, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily, weekly, semiweekly or triweekly newspaper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Acts of March 3, 1933, and July 2, 1946 (section 537, Postal Laws and Regulations), printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, The Industrial Press, 148 Lafayette St., New York 13, N. Y.

Editor, Clifford Strock, 148 Lafayette St., New York 13, N. Y.

Managing Editor, none.

Business Managers, Robert B. Luchars, 148 Lafayette St., New York 13, N. Y.; Edgar A. Becker, 148 Lafayette St., New York 13, N. Y.; Harold L. Gray, 148 Lafayette St., New York 13, N. Y.

2. That the owner is:

The Industrial Press, 148 Lafayette St., New York 13, N. Y.; Robert B. Luchars, 148 Lafayette St., New York 13, N. Y.; Edgar A. Becker, 148 Lafayette St., New York 13, N. Y.; Franklin D. Jones, 148 Lafayette St., New York 13, N. Y.; Walter E. Robinson, 148 Lafayette St., New York 13, N. Y.; Charles O. Herb, 148 Lafayette St., New York 13, N. Y.; Harold L. Gray, 148 Lafayette St., New York 13, N. Y.; Clifford Strock, 148 Lafayette St., New York 13, N. Y.; Suno E. Larson, 148 Lafayette St., New York 13, N. Y.; Helena E. Oberg, 65-82nd St., Brooklyn 9, N. Y.; Wilbert A. Mitchell, 28 Harlow Road, Springfield, Vt.; First National Bank and Trust Co. of Montclair and Robert B. Luchars, Trustees (Beneficiaries unknown), Upper Montclair, N. J.; First National Bank and Trust Co. of Montclair and Leigh Roy Urban, Trustees (Beneficiaries unknown), Upper Montclair, N. J.; First National Bank and Trust Co. of Montclair and Kenneth D. Ketchum, Trustees (Beneficiaries unknown), Upper Montclair, N. J.; Lee W. Urban, Guardian for Susan Yarnall Urban, 27 Clinton St., Oneonta, N. Y.; Lee W. Urban, Executrix of Will of Robert L. Urban, 27 Clinton St., Oneonta, N. Y.; John T. Urban, 224 Sullivan St., New York 12, N. Y.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are:

Charlotte B. Baldwin, 420 Clinton Ave., Brooklyn, N. Y.; John Connolly, 148 Lafayette St., New York 13, N. Y.; Franklin D. Jones, 148 Lafayette St., New York 13, N. Y.; Robert B. Luchars, 148 Lafayette St., New York 13, N. Y.; Louis Pelletier, 148 Lafayette St., New York 13, N. Y.; Elizabeth Y. Urban, 38 Lakeview Road, Asheville, N. C.; Helen L. Ketchum, 231 King St., Cohasset, Mass.; Wilbert A. Mitchell, 28 Harlow Road, Springfield, Vt.; Henry V. Oberg, 3375 Kenmore Road, Shaker Heights 22, Ohio.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

EDGAR A. BECKER, Treasurer

Sworn to and subscribed before me this 30th day of September, 1949.

CHARLES P. ABEL.

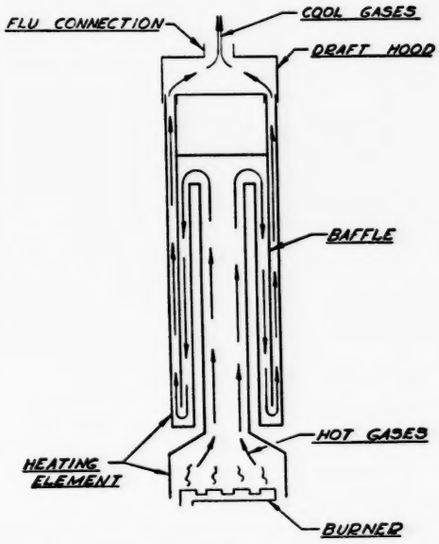
Notary Public, State of New York No. 24-0002700 Qual. in Kings Co. Certs. filed with N. Y. Co. Clerk, Kings & N. Y. Co. Registers. Term expires March 30, 1951.

Solarheat Heater

NAME — Solarheat panel heater, model 25.

PURPOSE—Wall model type of space heater.

FEATURES — The heating element



attains a maximum operating temperature of 450F to provide a delivery of warm air from the unit at a velocity of 215 fpm. Unit delivers a stream of 105 cfm warm air from a grille opening to mix with the room air. The intake is through a louver plate at the base of the heater. The temperature-sensing unit, which is a Robertshaw control, is located outside the heater cover, adjacent to the floor and exposed to the air stream entering the intake. The sensible heat loss in flue gas is only 16% of total output. The heating element is porcelain enameled. Deflectors at top of the unit prevent heat from following up wall above the unit. Should the gas pilot light go out for any reason, gas is automatically shut off to both the pilot and main burner on either the automatic or manual type models.

SIZES AND CAPACITIES — Input, 25,000 Btu. Height, 58¼ inches; width, 17½ inches; ⅜-inch connection to gas line.

MADE BY—*Kilbury Manufacturing Co., Inc., 14529 Hawthorne Blvd., Lawndale, Calif.*

Item 467

Area-Graphs

NAME—Area-Graph.

PURPOSE — Direct reading instrument for determining areas on drawings.

FEATURES — Instrument is constructed of plastic and consists of a number of hyperbolic curves. To determine an area, the instrument is placed over the area to be measured, and the reading is obtained directly.

SIZES AND CAPACITIES—The ⅛ inch scale is for areas up to 4,000 sq ft; the ¼ inch scale for areas up to 1,000 sq ft.

MADE BY—*Contractors Estimating Service, 515 Yazoo St., Jackson, Miss.*

Item 468

DECEMBER, 1949

TO OBTAIN FURTHER INFORMATION ON NEW EQUIPMENT

On the list below, circle the item number of the equipment in which you are interested, using the number found at the end of each item.

435	436	437	438	439	440	441	442	443
444	445	446	447	448	449	450	451	452
453	454	455	456	457	458	459	460	461
462	463	464	465	466	467	468		

Print your name and address, detach and mail to Editor, HEATING AND VENTILATING, 148 Lafayette St., New York 13, N. Y.

Name.....

(For prompt service, title and firm name must be shown above.)

Title (Must be shown).....

Firm (Must be shown).....

Business Address .....

City.....**Zone**....**State**.....

12/49

NEWS OF THE MONTH

CONSTRUCTION OUTLOOK

for 1950 viewed by statistical experts in light of survey of economic opinion and current trends.

The 1950 construction market will be a buyers' market. Restoration of normal competition is one phase of the current adjustment that may be said to be completed, in construction and in most other sectors of business, according to Thomas S. Holden and Clyde Shute of F. W. Dodge Corp.

Construction volume in 1950 will probably be very close to 1949 volume, odds favoring a moderate reduction in the total of contract dollars, rather than an increase.

This is equivalent to saying that the upturn in contract volume which took place in August and September of this year does not yet, in our opinion, show signs of being the beginning of a broad and sustained upswing.

• **UNKNOWN.**—If this appraisal is correct, it records a curious situation. The upturn in volume was accompanied by a firming of material prices and a leveling of construction costs, after twelve months of downward adjustment. In the past, attainment of a like degree of stabilization frequently constituted a base for broad expansion of the economy and a significant increase in construction activity. This was largely because a construction upturn represented in the main a return of private investment confidence. Today any appraisal must include guesses as to what big labor unions will do to key industries, what our own government will do, what impacts foreign economic conditions will have on the American economy.

• **ECONOMISTS.**—For this reason the opinions of qualified economists on the general economic outlook have assumed increased significance as background for estimating future construction trends. We find ourselves in substantial agreement with the majority of the views expressed by the 108 economists who contributed their opinions on the business outlook to F. W. Dodge Corporation's latest survey. They expect continuation of market readjustment in 1950 and moderate downtrends in wholesale commodity prices, cost of living, consumer spending, industrial and general business activity. A majority of them expect reduced volume of private non-residential building and engineering contracts and increased volume of public non-residential building and engineering contracts. While two-thirds of them expect reduced housing volume, the other third expects moderately increased housing activity.

• **MODERATE.**—While a prospect of a downtrend, however moderate, does not make exciting reading, it should be reassuring. The expected moderate downtrend is from a total contract volume which, in terms of dollars though not in terms of physical units, is likely to be the highest on record. By the end of September, 1949, the 37-states contract total recorded by Dodge had passed the dollar total recorded for the first nine months of 1948, with considerable likelihood that the fourth-quarter figures this year will exceed those of last year. Even this guess about the final quarter of this year is subject to the qualification that current strikes, if prolonged, could result in a serious setback between the date this is written and the end of December.

• **HOUSING.**—Considerations affecting the residential building prospect are mixed. Tending toward increasing activity are such factors as these: enormous consumer incomes, high level of personal savings, the recent re-entry of increased numbers of home buyers into the housing market after the lull of early 1949, the momentum of the current boom supported by favorable financing terms, the expected distribution of $2,800,000,000 to veterans as an insurance dividend in 1950. The enlarged public housing program, as authorized in the Housing Act of 1949, might temporarily increase the number of housing starts over the number that would otherwise be made, but will not, we believe, as a long-range proposition increase the total number of units that will be built.

Tending toward some curtailment of housing volume are the following factors: currently reduced numbers of new family formations below the 1947 peak will at some stage tend to reduce basic demand for new dwelling units; if rent control is finally abandoned in 1950, there is likely to be a considerable shifting of rental housing occupancy, with elimination of those artificial shortages that have resulted from rent control.

An expected drop of 3% in physical volume of new housing anticipates increased public, decreased private housing activity; it anticipates increased volume of private and public apartment building (most public housing projects will consist of multiple dwellings), approximately the same number of single-family houses built on owners' order for owners' occupancy as were so built this year, moderate reduction in single-family houses built by operative builders for sale or rent.

There is obviously implied in the estimates here presented an expectation that construction trend curves, currently on the upswing, will take a dip some time next year, if indeed the current strike situation does not cause a sharp curtailment of activity before the end of 1949. Viewed from this date such a dip, if it comes about, would more likely be of the nature of a further market adjustment than the beginning of a major downtrend.

• **BLURRED.**—The 1950 construction picture sketched in this statement is somewhat blurred in outline. It is the kind of picture, we believe, which portrays the actual outlook more realistically than would a more striking statement of positive conviction that a definite postwar construction trend is emerging among the confusions of the time.

This indeterminate trend will change some day. It

could change in the direction of a broad expansion of the American economy and the increased construction activity that almost inevitably attends such economic expansion. This consideration prompts us to add to our statement on the 1950 prospect some observations on potential long-term construction trends.

• **LONG RANGE.**—United States population is growing rapidly; the high birth rate of the 1940's exceeded expectations of population experts. Babies born in the 1940's will need schools in the 1950's. They will be marrying and starting families and needing houses in the 1960's.

Recent studies by qualified authorities have shown that American resources and American productivity can conceivably support a much larger population at a considerably higher standard of living than it presently supports. (See *America's Needs and Resources*, by J. Frederick Dewhurst and Associates; published by the Twentieth Century Fund, 1947: also, *Controlling Factors in Economic Development*, by Harold G. Moulton, published by The Brookings Institute, 1949.)

The fact that the current readjustment has been effected thus far with a minimum of business upset and with a moderate amount of unemployment is in very large part due to the high productivity of American industry, which made almost miraculous speed in overcoming shortages and in overcoming obstacles created by government and by recurring labor troubles. The postwar performance of construction material producers and of architects and builders has been as creditable as that of producers in other sectors of the economy. The postwar record of building labor has been singularly free from serious strikes and work-stoppages, as compared with recurring labor troubles in other major industries.

Record-breaking dollar totals of new construction in 1948 and 1949 did not represent record-breaking physical volume. The physical volumes of those two years were exceeded in the peak war year 1942 and, before that, in the peak years of the late 1920's.

• **CAPACITY.**—In those earlier boom years the American people were investing 14 to 15% of national income in new construction; in 1948 and 1949, only 8%. Since V-J Day new construction has been undertaken largely to meet urgent current needs, very little for meeting the needs of the long-range future.

The construction industry could, with little difficulty, expand its activities well beyond its current volume or the volume expected in 1950. Barring a shooting war, it is difficult to see any chance of material and manpower shortages, other than temporary ones, which would limit the volume of new construction the industry may be called upon to undertake. It is entirely a question of what the American economy will demand.

The American people can, if they choose, step up their construction expenditures very considerably. In 1948, the total of disposable personal income was an estimated $191,000,000,000. Of this, $12,000,000,000 was saved and about $179,000,000,000 spent for consumption goods and services. This represented more than a high standard of living; it meant luxurious living as compared with anything previously enjoyed by ourselves or by any other people. The total included unusually large expenditures for such durable goods as automobiles, house furnishing and equipment, radios and musical instruments, goods which were produced, if at all, in meager amounts during the war years.

Readjustments of 1949 have been accompanied by a very slight reduction in total personal income, which may suffer a further moderate decline in 1950. However, such vast spending power should provide ample margin for greater investment in capital facilities than has prevailed thus far since V-J Day.

NEW TYPE BURNER

helps gas utilities solve gas house heating problems.

The fuel trend in America today is definitely toward the use of automatic devices for heating homes. John L. Lewis has been a good salesman for the liquid fuel industries. This year again he may divert more house heating customers to liquid fuels because of shortages and increased prices of coal. Peak load demands again may vex some gas utilities, and to meet this problem the Gas Service Co. and the Midwest Research Institute of Kansas City, Mo., have perfected a new type of burner that will automatically switch from gas to oil and back again whenever gas may be in short supply, or inversely should heating oil be scarce.

• **SUPPLY.**—The gas industry is in much better position to meet added demand for house heating than at any time since the war. Expansion of production and distribution plants, increased supplies of natural gas being piped from the wells, new manufacturing processes and increased storage facilities have helped lift restrictions on sales of new gas heating in most areas.

The gas house heating load still poses an economic problem for many gas utilities. It creates high peak demands for brief periods of time. Sudden severe cold waves can tax production and storage capacities of even the largest systems. Still the untilities must provide complete service in cold spells as well as in temperate periods.

• **STANDBY.**—Peak load problems are not new to the gas industry and over the years many types of standby facilities have been adopted to offset the imbalance in loads created by house heating demands. But standby gas often is expensive gas, costing the utility many times the cost of the equivalent amount of base load gas. For this reason, the Gas Service Co., pioneering the field of combination oil and gas burners, believes that maintenance by the customer of standby facilities offers a double advantage. It affords peak load relief to the utility company and it brings the customer heating insurance with the knowledge that automatic heat will always be available.

• **CONTROLS.**—Several manufacturers are producing combination oil and gas burners. The equipment developed in Kansas City consists of a single unit designed to burn both types of fuel. Operation is entirely

automatic. An outside thermostat automatically switches over from gas fuel to oil fuel when the weather gets severely cold and automatically switches back to gas when the weather moderates. In most areas where house heating is required the thermostat is set to change from gas to oil at 20F. Since there is a slight lag in the outdoor control the switch back to gas is automatically effected when the outdoor temperature reaches 25F.

On an annual basis, the average customer will use about 15 to 20% oil and 85 to 80% gas. A basement or outdoor tank of 275 gallon capacity is sufficient to carry the average home through a normal winter with one filling which can be done in the summer when oil prices are low. The combination of the two fluid fuels —oil and gas—offers full protection against failure of heat in the homes and will make it possible for gas utilities to serve thousands of users who might otherwise be denied such service.

NO-SLAB CODE

halts Westchester County building development of ranch homes found O.K. on Long Island.

After a stormy public hearing that continued far into the night, Mayor Edward Ingalls and four Scarsdale, N. Y., village trustees voted unanimously at 3 a.m. November 16 to sustain a ban against construction of houses on radiant-heated concrete slabs that lack air space underneath.

By this action the village hindered further the effort of Sam Berger, builder of the "King Ranch" houses on Long Island, to construct such homes in the Quaker Ridge neighborhood of Scarsdale.

Predominating in the neighborhood are bigger and more costly houses of varied design and traditional construction. Some residents have objected to the six-room houses that Mr. Berger already has started to build on half-acre plots for $16,500.

Mr. Berger, who has sold all the forty-six houses from plans, revealed the move that he would submit revised specifications to the village, although he believed the original arrangement for houses on surface slabs complied fully with the building code.

The builder told the board that putting an air space under a house was not sensible, as it did not improve drainage and merely made a place for vermin and rubbish, but that he could build a timber floor above ground at no greater expense than pouring concrete slabs at ground level.

• **200 PERSONS.**—The hearing in the fire house at Village Hall was attended by 200 persons. It concerned an appeal from the revocation by Peter M. Ferraro, building inspector, of permits for eleven houses being built by Mr. Berger's company, Colonial Ranch, Inc., in a new subdivision beside the Hutchinson River Parkway in Quaker Ridge, and revocation of a permit for a small $15,000 slab-based house that Robert Beckley, a war veteran, is building for himself at 22 Wynmor Road in Heathcote. The board denied the appeal.

Arthur D. Brennan, counsel for Colonial Ranch, told the board that plans for all the forty-six houses of the Berger company were approved by Mr. Ferraro on Sept. 21, that permits for eleven were issued forthwith, but that on Oct. 29 the permits were revoked by Mr. Ferraro, who said the building code of the village required at least thirty inches of air space between the ground and the first floor.

Mr. Brennan declared that this provision in the code applied only to wooden floors that might rot and never was intended for radiant heated slabs of concrete. He cited also a provision in the code that allowed Mr. Ferraro to grant variances.

Abraham H. Salkowitz, architect for the houses, said slab construction was standard throughout the country and was approved by the Federal Housing Administration. Alfred R. Marcks, vice president of the Dime Savings Bank of Brooklyn, reported that it was financing the Scarsdale Houses and had lent more than $15,000,000 in recent years on similar homes.

• **"DISCRIMINATION."**—Robert E. L. Howe, Scarsdale Democratic chairman, said the revocation of the permits was "discrimination." Some purchasers from New York said they considered it proof they were "not wanted" in Scarsdale.

Mr. Beckley asked why the permits for his house and the Colonial Ranch structures should be revoked if Kenneth Metz were allowed to continue with construction of a $35,000 ranch-type house on a concrete slab at Fayette and Carthage Roads.

Assemblyman Samuel Faile of White Plains, counsel for neighbors, asked for strict compliance with the building code, declaring that Mr. Berger was a speculative builder and should be compelled to erect permanent structures.

Edwin A. de Lima, spokesman for the Quaker Ridge Association, said that the slab type of construction was merely a short cut to lower costs. He declared that the concrete floors in the clayey soil of Westchester would collect moisture, cause rugs to mildew and framework houses to rot.

TILE FLOOR PANELS

heat Long Island homes with warm air.

A feature being used by a Long Island, N. Y., builder is a heated floor which is built up of (1) gravel fill in which are embedded warm air supply and return ducts of U-shaped concrete "blocks," (2) a honeycomb of ordinary three-cell clay partition tile, (3) a layer of 2½ inches of concrete, and (4) an asphalt tile finish.

• **SPLIT.**—Tiles are arranged to create heating panels, one of which exhausts into the living room, 6 ft 8 in. up in the bedroom partition. Through this outlet the furnace delivers warm air in less than 15 minutes, offsetting the two-hour lag in the floor panels. A return grille is located near the floor in the bedroom hall close by the heating plant.

DUST COUNTER

for ultra-fine particles will aid in atmospheric pollution studies and artificial rain development.

An instrument that counts invisible particles in the air a million billion times smaller than a grain of sand has been developed by Dr. Bernard Vonnegut, weather scientist in the General Electric Co.'s Research Laboratory at Schenectady, N. Y. It was described by him in a paper presented before the National Air Pollution Symposium, which met recently in Pasadena, Calif.

The work was done under Project Cirrus, joint weather research program of the U. S. Army Signal Corps, and the Office of Naval Research, in consultation with the G-E Research Laboratory. The device will be used by Dr. Vonnegut and other G-E weather scientists to study the behavior of particles in the atmosphere, determine how they disperse, find out how far they travel, etc.

• **USES.**—Such knowledge will be useful in developing atmosphere-seeding techniques with silver iodide, which in similar small particle form causes supercooled or below-freezing moisture to turn to snow.

The device also should prove useful in air pollution studies to trace the development and dissipation of various smokes from industrial centers and populated areas, according to Vonnegut.

Particles the instrument detects are less than a millionth of an inch in diameter, and, by comparison, a grain of sand weighs approximately one million billion times more.

Particles are found in concentrations as low as 1,000 per cubic inch but have been noted as high as 10,000,000 per cubic inch.

In use thus far the instrument has detected high concentrations of particles in clouds five miles high, indicating that silver iodide particules could be similarly dispersed. High concentrations have been found in areas subject to smoke pollution, especially those down-wind from a city.

• **HOW IT WORKS.**—As described in the paper, the instrument consists principally of a cloud chamber, through which a beam of light is directed, an air pump which compresses and expands air three times a second in the cloud chamber, a moisture supply which introduces moisture into the chamber, and a light-sensitive photoelectric cell or electric eye which watches the beam of light.

Air to be tested for appearance of particles continuously passes through the cloud chamber. Three times per second the sudden expansion of this air causes condensation of moisture on any particles present, resulting in fog of various densities.

The amount of light scattering from the beam is in proportion to the number of fog drops formed, and any changes in the light scattering are detected by the electric eye and transmitted as electric impulses to a recorder which automatically indicates the change graphically on paper. The number of particles is then determined by calibration.

NO POWER CURTAILMENT

now or later in USA except for Pacific Northwest—doubling of 1940 generating capacity in sight by 1952.

The specter of impending power shortages raised frequently in some quarters over the past several years should be laid by the recently completed findings of the Power Survey Committee of the Edison Electric Institute, Elmer L. Lindseth, president of the institute, said in releasing the results of the committee's latest semi-annual survey.

The survey establishes these facts for the immediate present and next few months:

• **CAPACITY.**—The electric industry will have a reserve generating capacity of 11½%, on a nationwide average, during the December peak load period. This margin contrasts with a 5.9% reserve last December. Generating capacity will have increased 26% in three years' time by the end of 1949. This percentage represents over 13 million kilowatts of new capacity—an addition exceeding the total generating capacity of the industry in 1920.

No power curtailment is in effect anywhere in the country, except in the Pacific Northwest where the extreme low river flow has caused the shutting off of some consumption; nor, with this exception, is any curtailment expected, although an extreme drought in some other area depending primarily on hydroelectric power might slightly alter the situation for such an area.

Manufacturers of generating equipment are now able to produce 8 million kilowatts of steam-turbine capacity and 2 million kilowatts of hydroelectric capacity—a total annual factory production capability of 10 million kilowatts.

• **FUTURE.**—For the next three years, the survey indicates the following developments:

By the end of 1950, the normal generating reserve capacity of 15% is expected to be reached.

For 1952, planned capacity additions thus far determined upon, and announced for the first time in this survey, will total 4,349,000 kilowatts.

During the post-war years 1947-1952 new generating capacity installations will reach nearly 30 million kilowatts, bringing the total generating capacity of the nation's electric industry to 80 million kilowatts. This figure is slightly more than double the generating capacity in 1940.

Eighty-one per cent of the new generating installations will use fuel, while the remaining 19% will be hydroelectric.

• Sales of automatic gas water heaters for the year of 1949 will probably total 1,350,000 units, Edward R. Martin, chief statistician, Gas Appliance Manufacturers Association, reported. This estimate was based on sales figures for the first ten months of 1949 and showed a steady gain since January 1949.

FLY ASH USES

may eliminate costly disposal problem, ASME hears.

New developments in the use of fly ash which promise to solve a disposal problem that saddles privately owned utilities with an investment in collecting equipment rapidly approaching $60,000,000, were outlined at the 70th annual meeting of The American Society of Mechanical Engineers in the Statler Hotel in New York.

• **COSTLY.**—The new uses for the ash, which is the residue from the burning of pulverized coal, were described during a symposium by prominent power plant research engineers. The results of a survey of all the principal consumers of pulverized coal in this country were given by Henry S. Walker, director of research for The Detroit Edison Co. During 1948, he said, over $1,000,000 was spent in disposing of 1,500,000 tons of collected fly ash by companies consuming over 65% of the pulverized coal burned, with the cost expected to increase by 50% in a year or two.

Privately owned utilities have at present an investment of approximately $30,000,000 in equipment to collect fly ash and this figure will increase shortly to $60,000,000 with the further installation of collectors in existing and new power plants, said Mr. Walker. Except for a very small portion, he added, the collected ash remains a nuisance for the operating company to dispose of without much aid from sale. He said dumping is usually the principal means of getting rid of it, but adjacent dumping grounds are not always available.

• **SOIL.**—The most recent application for fly ash, giving great promise of providing a very real market, is its use in the field of soil stabilization, with particular emphasis upon road construction, declared M. C. Randall, senior engineer, Philadelphia Electric Co. A mixture of limestone screenings, fly ash and a small amount of hydrated lime has been developed at Philadelphia Electric for use as a base course for supporting a concrete pavement and as a cementitious fill to replace the customary limestone screenings normally used as the base course for bituminous concrete pavement.

He said a number of experimental installations of this type construction have been made, but as yet these installations have had insufficient service to definitely prove its superiority over standard construction. He said, however, that installations of Cor Crete, as it is tentatively termed, have been made utilizing it as the wearing surface on parking lots, driveways, walkways and the like, with every indication it is admirably suited to such use.

Cost-wise, said Mr. Randall, it should be relatively inexpensive, running in the neighborhood of crushed stone.

"If this one product alone develops and becomes a part of state road specification the demand could without too great a stretch of imagination exceed the local fly ash production," he declared.

• **CEMENT.**—Other fly ash applications described by Mr. Randall were its use in insulating cements, building brick and in steel foundries to provide hot strength for core and molding sand, as a replacement for silica flour. It will do the same work as silica flour, he said, and in some instances work even better in the case of larger castings.

When used in the making of cement, a remarkable lack of shrinkage was noted when the cement had dried, and there was excellent adhesion to base insulating materials, said Mr. Randall, adding that the workability was found to be good and coverage equal if not somewhat better than the present commercially available cements.

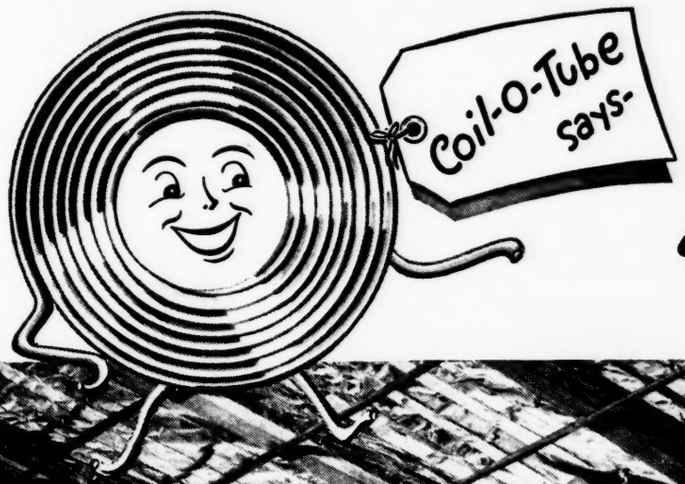
"It was also found, that due to the high adhesion and low shrinkage, a single coat could be applied without the use of wire mesh reinforcement. Further, paint could be applied directly to the finishing cement without the usual canvas jacket," he said. This cement will successfully withstand temperatures up to 1,700F, he said, permitting its use for turbine insulation.

Walter N. Handy, sales manager, Combustion By-Products Co. of Chicago, described the use of fly ash in concrete as a part of the cementing material. Laboratory tests and field experience, he said, show the following advantages: reduced temperature rise, reduced thermo and drying shrinkage, increased workability, resistance to freezing and thawing, resistance to sulphate attack and additional gain in strength at later ages. He said fly ash is presently being used in a large dam, several paving projects, a large sewer and several power generating stations.

The procedure used by The Detroit Edison Co. in developing the use of fly ash in the bitumastic road industry was outlined by C. M. Weinheimer, head of the mechanical division for that company. He said 31,200 tons of fly ash were sold by Detroit Edison in 1946 for use as a mineral filler in bitumastic road construction.

• Radiant panel heating is being tested under "almost impossible" conditions in engineering experimental tests at Michigan State College. Results of tests with a fin tube ceiling panel in a drafty steel classroom building will go far in determining the value of the system under all conditions, according to Lorin G. Miller, dean of the School of Engineering. The building has never before been insulated or successfully heated, Dean Miller said. Equipment installation is under the joint auspices of the Kritzer Radiant Coils, Inc., of Chicago, and the AAA Engineering Sales Co., of Detroit and Lansing, sponsors of the project.

• Top government housing officials said that the production of more lower-priced and more rental housing is responsible for the new record year in homebuilding foreseen for 1949. The statement followed a joint estimate by the Department of Labor and the Department of Commerce that this year's total nonfarm residential construction will near the million mark, exceeding the previous 1925 record of 937,000 units.



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All of these time-saving advantages save money for you. So, on your future radiant panel heating jobs, figure the cost with Revere Copper Water Tube . . . and you'll be using this easy-to-install tube every time.

Revere Copper Water Tube is stamped at regular intervals with the Revere name and the type. Look for these marks! They are more than identification . . . they are your assurance of easy bending and of the close dimensional tolerances so essential for tight soldered joints.

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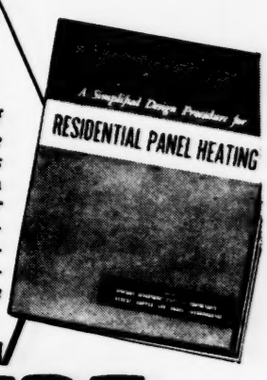
Write today for your free copy of "A Simplified Design Procedure for Radiant Panel Heating." This booklet contains all the facts you need to accurately design floor or ceiling systems for the average residence or other non-mechanically-ventilated structure. It's the simplest, most rapid method of design ever published!



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Abstracts and Reviews

Publications abstracted in this department should be ordered direct from publisher.

TUBULAR EXCHANGER STANDARDS

A group of eleven leading manufacturers of shell and tube sheet exchangers have made possible the 1949 publication of standards of the Tubular Exchanger Manufacturers Association. The first edition was published in 1941 to set forth the recommended standards of the association for the mechanical and thermal design and construction of cylindrical shell and bare tube heat exchangers. This edition, which is the only one published since 1941, was prepared under the editorship of Townsend Tinker, chief engineer, Ross Heater & Mfg., Inc., Division of American Radiator & Standard Sanitary Corp. Within this 94-page, wire-bound book is a wealth of information on the various types of tubular heat exchangers.

Standards of Tubular Exchanger Manufacturers Association, 1949 Edition. Paper cover, 8½ x 11, 94 pages. Published by Tubular Exchanger Manufacturers Association, Inc., 53 Park Place, New York 7, N. Y. Price, $3.00.

• • •

CHIMNEY CHECK CHART — Sixteen commonly encountered defects that cause insufficient chimney draft are shown in a chimney check chart published by the Institute of Boiler and Radiator Manufacturers. This chart also indicates how to locate the trouble spots and how the problems may be corrected and is intended to serve as a complete guide to chimney efficiency, to be used as a convenience and help in trouble shooting in heating plants. Institute of Boiler and Radiator Manufacturers, 60 E. 42nd St., New York 17, N. Y.

MODULAR COORDINATION—A 20-page illustrated booklet has been issued to describe modular coordination and how it works in reducing housing cost. Modular coordination is a term to describe the use of a basic standard unit of measurement in housing materials and housing design. Booklet is written in non-technical language. Price, 15 cents, Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

STANDARD FOR REFRIGERATION SERVICE COPPER TUBE —Developed at the request and in cooperation with the Copper and Brass Research Association, a recommended commercial standard for refrigeration service has been sent out to interested parties for acceptance by the National Bureau of Standards. It provides minimum requirements for eight standard sizes of seamless annealed copper tube manufactured for refrigeration service in sizes from ⅛ to ¾ inch outside diameter. The recommended standard covers manufacture, chemical composition, workmanship and finish, weight and tolerances. Commodity Standards Division, National Bureau of Standards, Washington 25, D. C.

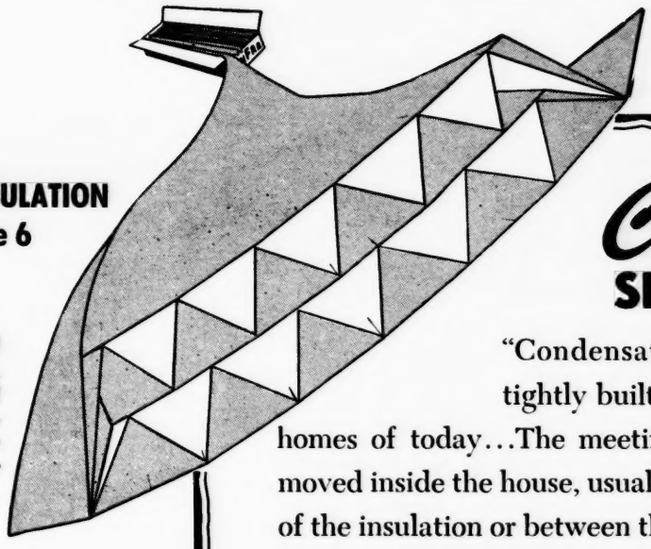
BOILERS AND COMBUSTION.—The Boilers and Combustion Subcommittee of the Prime Movers Committee, Edison Electric Institute, has issued a 49-page report covering Boilers and Combustion, 1948. It contains statements from the committee and operating companies regarding fuel burning equipment, external tube deposits, soot blowers, combustion air and ventilation, ash hoppers, ash handling and dust removal equipment, stokers, combustion control equipment and other data relating to the general subject. Price to nonmembers, $2.50. Edison Electric Institute, 420 Lexington Ave., New York 17, N. Y.

WARM AIR FURNACES—The third edition of Commercial Standard CS104-49 of warm air furnaces equipped with vaporizing type oil burners is now available. This revised commercial standard provides for a field test and the posting of an installation certificate. It also presents the basis for certification of the quality and performance of such type furnaces and oil burners. The standard includes a list of the firms and organizations that have adopted it as standard practice. Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Price, 10 cents.

RESEARCH ON DOMESTIC STOKERS—Information on current research and development work by individual stoker manufacturers is contained in an article on Research on Domestic Stokers and on Stoker Coal—Yesterday, Today and Tomorrow, by Charles H. Sawyer. It reviews the research work that has been done by various agencies at many laboratories and presents data on recent developments in the field. Price, 25 cents. Stoker Manufacturers Association, 207 N. Michigan Ave., Chicago 1, Ill.

ANALYSES OF IOWA COALS — Information on coals mined in Iowa is contained in technical paper 706—Analyses of Iowa Coals. This state, which ranks 18th among coal producing states, has mined a considerable amount of coal. Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Price, 25 cents.

AIR POLLUTION IN DONORA, PA.—The epidemiology of the unusual smog episode that occurred in Donora, Pa., in October, 1948, is covered in an extensive report published by the U. S. Public Health Service as Public Health Bulletin No. 306. This extensive report of 173 pages covers such important facts as a plan of the investigation, biological studies, atmospheric studies, discussion of the cause of the episode, and recommendations. This report indicates that in addition to the twenty deaths that were publicized by the newspapers at the time of the incident, 5,910 persons, or 43% of the population, became ill due to the smog that hung over the community for five days. For a copy, write to the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Price, $1.25.



INFRA INSULATION
Type 6

Cost of Infra installed between wood joists, for material and labor, should be under 10¢ per sq. ft. for Type 6; under 8¢ for Type 4.

Infra Solves the Problem

INFRA Insulation, Type 6, is an impermeable vapor barrier, it weighs but 1¼ oz. per sq. ft. With so little thermal capacity there is practically no exchange of heat for condensation to take place. The construction—4 inner rows of reflective air cells of slight conduction, between 3 radiant-heat-repelling aluminum sheets of only 3% emissivity, effectively prevents contact of condensation-forming temperature extremes.

Infra, which cannot form, absorb nor store appreciable moisture, has 97% efficiency in rejecting radiant heat, which represents 65% to 80% of heat flow thru wall spaces. It is also singularly effective in blocking conduction and convection heat transfer.

Condensation
SEVERE PROBLEM

"Condensation...severe problem in the tightly built, well-insulated, high humidity homes of today...The meeting place of warm and cold is moved inside the house, usually somewhere in the outer layer of the insulation or between the insulation and the sheathing. The vapor then collects inside the attic or the walls and the result is plenty of trouble.

"Wet spots on the ceiling or walls, as the moisture flows down from the cold attic space; falling plaster as an end result; constant and repeated paint failures on the outer walls and gable ends; and rotting rafters, joists, studs, sheathing, and shingles or siding; these are only too common and costly results of the over-insulated, under-moisture-proofed home.

"The easiest solution, of course, is the inclusion of a good vapor barrier when the house is built...A series of laboratory tests made by the Forest Products Laboratory and the University of Wisconsin in 1947...Aluminum foil had by far the best rating as a vapor barrier."

From "Weather-Conditioning of Roofs for Residences" by Groff Conklin, "Progressive Architecture," Nov. 1949.

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Down-Heat	**C.044, R 22.72 = 7½" dry rockwool**
Up-Heat	**C.08, R 12.50 = 4" dry rockwool**
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DEGREE-DAYS FOR OCTOBER, 1949

(A) Airport readings (C) City office readings; (O) Readings at a point on outskirts of city.

HEATING AND VENTILATING's 22nd Year of Publication of Monthly Degree-Day Data

City	October			Cumulative, September 1 to October 31			Heating Season[1]
	1949	1948	Normal	1948-49	1947-48	Normal	Normal
Abilene, Texas (A)	137	100	0	143	110	0	2061
Albany, New York (A)	(a)	509	446	(a)	645	518	6580
Albuquerque, New Mexico (A)	290	244	273	296	324	273	4298
Alpena, Michigan (C)	417	549	570	677	679	792	8299*
Anaconda, Montana (C)	828	600	647	1131	916	982	8357**
Asheville, North Carolina (C)	141	329	276	241	376	276	4232
Atlanta, Georgia (C)	41	157	96	64	164	96	2890
Atlantic City, New Jersey (C)	117	268	254	174	308	254	5176
Augusta, Georgia (A)	10	120	16	14	124	16	2161
Baker, Oregon (C)	686	536	552	850	811	810	7163
Baltimore, Maryland (C)	98	268	223	145	293	223	4533
Billings, Montana (A)	717	445	524	920	569	713	7119
Binghamton, New York (C)	315	482	453	515	614	561	6808
Birmingham, Alabama (A)	39	154	0	64	158	0	2352
Bismarck, North Dakota (A)	646	586	626	918	685	848	9192
Block Island, Rhode Island (C)	191	314	279	269	377	279	5788
Boise, Idaho (A)	576	394	434	666	549	536	5552
Boston, Massachusetts (A)	230	341	363	335	417	411	6045
Bozeman, Montana (C)	817	579	651	1099	807	987	8521**
Buffalo, New York (A)	273	478	419	479	571	494	6822
Burlington, Iowa (A)	284	406	(a)	466	462	(a)	(a)
Burlington, Vermont (A)	378	579	481	575	742	625	7514
Butte, Montana (C)	851	652	655	1177	990	999	8235**
Cairo, Illinois (C)	135	207	158	188	222	158	3909
Canton, New York (C)	382	588	557	619	762	746	8020
Charleston, South Carolina (C)	0	87	0	0	87	0	1769
Charlotte, North Carolina (C)	58	184	115	86	202	115	3120
Chattanooga, Tennessee (A)	69	234	105	105	237	105	3118
Cheyenne, Wyoming (A)	666	579	845	884	722	845	7466
Chicago, Illinois (C)	224	337	326	350	356	402	6077
Cincinnati, Ohio (C)	146	312	254	232	338	254	4684
Cleveland, Ohio (A)	229	464	366	409	539	393	6155
Columbia, Missouri (C)	227	279	260	339	310	260	4922
Columbia, South Carolina (C)	23	134	31	36	141	31	2364
Columbus, Ohio (C)	187	380	313	317	425	313	5398
Concord, New Hampshire (A)	427	546	484	661	730	652	7353
Concordia, Kansas (C)	242	288	276	338	321	276	5315
Dallas, Texas (A)	110	65	0	115	67	0	2256
Davenport, Iowa (C)	256	365	363	408	407	363	6289
Dayton, Ohio (A)	236	452	273	418	507	273	5264
Deer Lodge, Montana (C)	787	659	733	1097	1045	1132	8672**
Denver, Colorado (C)	451	378	428	527	415	500	5874
Des Moines, Iowa (C)	276	366	357	412	402	357	6384
Detroit, Michigan (A)	270	462	400	452	536	442	6490
Devils Lake, North Dakota (C)	701	582	706	1002	700	982	9970
Dodge City, Kansas (A)	279	253	276	348	287	276	5035
Dubuque, Iowa (C)	304	423	409	494	480	445	6790
Duluth, Minnesota (C)	558	522	626	873	659	896	9483
Eastport, Maine (C)	426	530	543	664	802	819	8520**
Elkins, West Virginia (A)	270	512	378	490	641	441	5697
El Paso, Texas (A)	139	102	40	139	104	40	2428
Ely, Nevada (A)	679	628	(a)	679	628	(a)	(a)
Erie, Pennsylvania (C)	219	423	378	366	490	414	6273
Escanaba, Michigan (C)	464	553	591	769	676	834	8771
Evansville, Indiana (A)	172	318	155	284	340	155	4244
Fort Smith, Arkansas (A)	163	160	62	198	170	62	3147
Fort Wayne, Indiana (A)	279	475	347	481	542	347	5925
Fort Worth, Texas (A)	115	59	0	121	60	0	2148
Fresno,California (A)	142	64	19	143	82	19	2334
Galveston, Texas (C)	19	16	0	19	16	0	1016
Grand Junction, Colorado (A)	433	337	369	464	355	369	5548
Grand Rapids, Michigan (C)	266	443	419	450	498	476	6535
Green Bay, Wisconsoin (C)	430	528	505	706	652	637	7825
Greensboro, North Carolina (A)	114	302	143	166	330	143	3529
Greenville, South Carolina (A)	58	191	146	99	210	146	3380
Harrisburg, Pennsylvania (A)	201	382	329	317	453	329	5375
Hartford, Connecticut (A)	257	414	344	389	504	392	6036
Hatteras, North Carolina (C)	9	121	0	10	121	0	2571
Havre, Montana (C)	688	547	620	899	724	890	8700
Helena, Montana (A)	791	646	614	1092	901	865	7894**
Houston, Texas (C)	32	23	0	32	23	0	1157
Huron, South Dakota (A)	503	504	526	718	583	649	8004
Indianapolis, Indiana (A)	221	427	298	376	479	298	5298
Jackson, Mississippi (A)	36	82	(a)	46	94	(a)	(a)
Kansas City, Missouri (A)	195	238	219	274	251	219	4956
Knovxille, Tennessee (A)	83	249	183	133	261	183	3670
La Crosse, Wisconsin (A)	376	487	462	623	585	558	7322
Lander, Wyoming (A)	792	569	654	990	705	930	7947

(a) Data not available.

[1]Figures in this column are normal totals for a complete heating season, September to June, incl.

Figures in this table, with seven exceptions, based on local weather bureau reports. Exceptions are Utica and Lewiston, figures for which are furnished through the courtesy of Coke Sales Department, Central New York Power Corp., Utica, N. Y., and Norman E. Ross, Bursar, Bates College, Lewiston, Me., respectively; Anaconda, Bozeman, Butte, Deer Lodge and Livingston, Mont., through the courtesy of the Montana Power Company.

[Table concluded on page 112]

A NEW DESIGN FOR '49

MORE HEAT
LESS SPACE
SAVES LABOR !

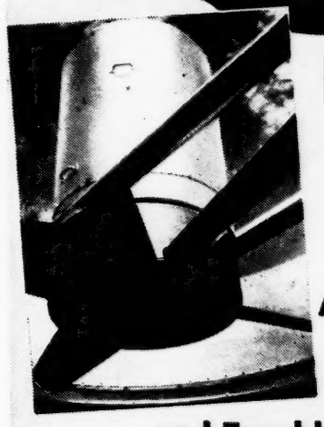
Stedco Compact Convection

- Modern Streamlined Appearance
- Convection for Hot Water or Steam
- Ample Capacity for any size Room
- Consumes a minimum of space
- Ideal for new construction or remodeling
- Allows maximum air circulation
- Requires no recessing
- Does not smudge walls or furnishings
- For Residential, Commercial or Industrial Installation

STEDCO Compact Convection Elements are made of 1¼" IPS Seamless tubing with 22 gauge fins. One lineal foot of STEDCO radiation gives 1848 BTU or 7.7 square feet of EDR per hour.

Stedco Products
KINGSTON PENN

Pritchard



COOLING TOWERS

Thoroughly Engineered*
Adequately Sized

*For Longer Life and Trouble-Free Performance

THREE LEADING LINES
Cooling Towers
Heat Exchangers
Gas Equipment for
FIVE MAJOR FIELDS
Chemical, Natural Gas, Petroleum, Power and Refrigeration.

EQUIPMENT DIVISION
908 Grand Ave. Kansas City 6, Mo.

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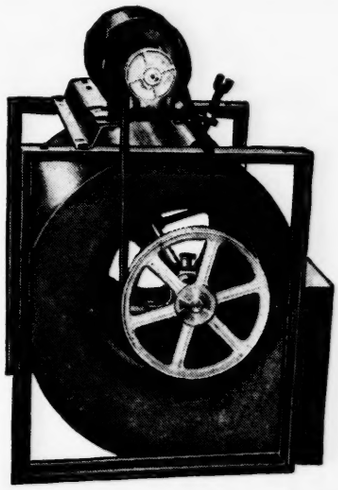
Representatives in Principal Cities

J.F. Pritchard & Co.
ENGINEERS • CONSTRUCTORS • MANUFACTURERS
for the CHEMICAL, PETROLEUM, GAS & POWER industries



THE
NEW
UNIVERSAL
TYPE "N"
BLOWER

MASSACHUSETTS . .

By changing the position of the oil cup, the four popular discharges (lower horizontal, upper horizontal, down-blast and up-blast) can be obtained. Sizes 7 to 16½ inches wheel diameter.

WRITE FOR BULLETIN No. 110 CATALOG

MASSACHUSETTS BLOWER DIVISION
The BISHOP & BABCOCK Mfg. Co.
4901 HAMILTON AVENUE · CLEVELAND 14, OHIO

Degree-Days for October, 1949 (Concluded)

(A) Airport readings (C) City office readings; (O) Readings at a point on outskirts of city.

HEATING AND VENTILATING's 22nd Year of Publication of Monthly Degree-Day Data

City	October			Cumulative, September 1 to October 31			Heating Season[1]
	1949	1948	Normal	1948-49	1947-48	Normal	Normal
Lansing, Michigan (A)	335	520	481	582	618	595	7048
Lewiston, Maine (O)	424	520	501	625	640	666	7707
Lincoln, Nebraska (C)	268	333	316	390	375	316	5999
Little Rock, Arkansas (A)	115	141	47	142	151	47	2811
Livingston, Montana (C)	709	453	523	944	628	750	7245**
Los Angeles, California (C)	54	38	0	54	42	0	1504
Louisville, Kentucky (A)	152	309	186	245	333	186	4180
Lynchburg, Virginia (A)	142	314	220	227	366	220	3980
Macon, Georgia (C)	10	143	6	15	146	6	2201
Madison, Wisconsin (C)	323	451	459	543	520	546	7429
Marquette, Michigan (C)	432	524	567	731	685	792	8693*
Memphis, Tennessee (A)	111	174	62	140	190	62	2950
Meridian, Mississippi (C)	31	110	22	43	121	22	2160
Milwaukee, Wisconsin (A)	357	460	450	560	533	534	7245
Minneapolis, Minnesota (A)	376	428	481	587	486	574	7850
Montgomery, Alabama (C)	13	74	0	18	77	0	1884
Nantucket, Massachusetts (A)	287	375	335	389	487	398	5957
Nashville, Tennessee (A)	121	226	136	164	246	136	3507
New Haven, Connecticut (A)	241	349	360	349	420	399	5895
New Orleans, Louisiana (C)	10	32	0	10	121	0	1024
New York, New York (C)	123	289	272	176	309	322	5274***
Nome, Alaska† (A)	553	827	744	553	827	744	14580**
Norfolk, Virginia (C)	43	174	99	55	175	99	3350
North Head, Washington (C)	451	372	366	652	594	621	5452**
North Platte, Nebraska (A)	452	405	434	608	465	476	6366
Oakland, California (A)	221	160	183	259	267	273	3143**
Oklahoma City, Oklahoma (C)	171	114	105	209	120	105	3613
Omaha, Nebraska (A)	280	342	329	417	378	329	6131
Oswego, New York (C)	281	492	459	453	610	573	7088
Parkersburg, W. Virginia (C)	172	390	285	299	440	285	4775
Peoria, Illinois (A)	266	398	381	434	437	384	6109
Philadelphia, Pennsylvania (C)	118	268	235	164	289	271	4737***
Phoenix, Arizona (C)	49	14	0	49	14	0	1405
Pittsburgh, Pennsylvania (C)	192	398	313	312	458	313	5235
Pocatello, Idaho (A)	697	518	499	827	683	655	6655
Portland, Maine (A)	419	526	477	658	686	639	7218
Portland, Oregon (C)	432	307	332	491	428	437	4469
Providence, Rhode Island (C)	231	351	348	331	419	411	6015
Pueblo, Colorado (A)	418	392	388	461	433	394	5514
Raleigh, North Carolina (C)	57	209	130	83	223	130	3234
Rapid City, South Dakota (A)	554	448	515	738	524	659	7118
Reading, Pennsylvania (C)	166	330	344	259	380	344	5389
Red Bluff, California (A)	112	66	(a)	114	85	(a)	(a)
Reno, Nevada (A)	534	438	453	673	601	597	5892
Richmond, Virginia (C)	105	240	161	141	268	161	3695
Rochester, New York (A)	315	494	431	524	608	503	6732
Roseburg, Oregon (C)	443	313	350	494	448	461	4428
Roswell, New Mexico (A)	262	209	186	269	239	186	3484
Sacramento, California (C)	132	89	71	135	117	71	2653
St. Joseph, Missouri (A)	233	310	248	339	334	248	5161
St. Louis, Missouri (C)	175	243	205	245	259	205	4585
Salt Lake City, Utah (A)	520	380	388	578	466	406	5555
San Antonio, Texas (A)	40	32	126	40	32	126	1202
San Diego, California (A)	60	50	34	61	56	34	1645
Sandusky, Ohio (C)	199	437	353	319	481	353	6208
San Francisco, California (C)	218	158	146	324	312	260	3264**
Sault Ste. Marie, Michigan (A)	507	622	623	862	815	899	9285**
Savannah, Georgia (A)	0	78	0	1	78	0	1490
Scranton, Pennsylvania (C)	259	434	397	425	533	457	6129
Seattle, Washington (C)	433	390	394	545	570	580	4934**
Sheridan, Wyoming (A)	696	494	636	929	627	900	8008
Shreveport, Louisiana (A)	81	71	0	90	71	0	1938
Sioux City, Iowa (A)	358	420	415	538	469	448	6898
Spokane, Washington (A)	644	551	515	799	787	707	6355
Springfield, Illinois (C)	216	290	282	312	317	282	5373
Springfield, Missouri (A)	232	262	217	338	304	217	4428
Syracuse, New York (A)	297	500	425	477	635	521	6893
Tacoma, Washington (C)	477	434	400	633	664	607	5181**
Terre Haute, Indiana (A)	220	394	233	358	436	233	4872
Toledo, Ohio (A)	263	497	369	466	572	378	6077
Topeka, Kansas (C)	208	232	236	287	252	236	4969
Trenton, New Jersey (C)	167	323	242	251	369	242	4933
Utica, New York (O)	231	440	430	377	531	612	6796
Valentine, Nebraska (C)	522	484	490	712	558	583	7039
Walla Walla, Washington (C)	443	401	332	507	532	362	4808
Washington, D. C. (C)	116	283	251	171	310	251	4626
Wichita, Kansas (A)	218	185	192	277	204	192	4673
Williston, North Dakota (C)	682	570	660	959	691	930	9323
Winnemucca, Nevada (C)	631	454	507	757	607	699	6427**
Yakima, Washington (A)	(a)	482	437	(a)	673	557	5599

(a) Data not available.
†Nome data are for September.

*Includes August.
**Includes July and August.
***New 48-year normal covering 1898 to 1946.

[1]Figures in this column are normal totals for a complete heating season, September to June, incl.

Bryant Industrial

COIL CAGE BURNERS FOR IMMERSION FIRING

ENGINEERED FOR SIMPLE AND CORRECT BURNER APPLICATION

Complete assemblies for gas-firing immersed tubes for heating water, solutions, oils and other liquids, and certain low-temperature soft metals and salts. Easily mounted on tank or coil by lugs or setscrews with burner held securely in place. 15,000 to 1,200,000 Btu per hour inputs. Available with a wide variety of Bryant ignition and piloting devices for various types of applications. (*Write for Data Sheet 1C-1*)

BRYANT INDUSTRIAL DIVISION
Affiliated Gas Equipment, Inc.
1020 LONDON ROAD • CLEVELAND 10, OHIO

THERM-O-TILE
Reg. U. S. Pat. Off.

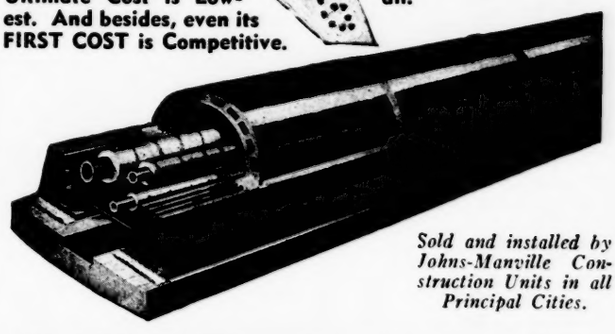
UNDERGROUND STEAM CONDUIT

We previously told you about eleven of the remarkable New York City Housing Projects that installed Therm-O-Tile this year—1949. Here is Job No. 12, shown at the left—the

LESTER W. PATTERSON HOUSES, BRONX, N. Y.

For a more complete understanding of these large projects see our ad in the January 1949 issue of Heating, Piping & Air Conditioning which pertains to the LARGEST of them all.

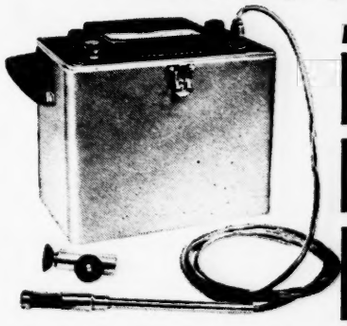
Therm-O-Tile is Stronger. More Efficient. More Economical because its Ultimate Cost is Lowest. And besides, even its FIRST COST is Competitive.



Sold and installed by Johns-Manville Construction Units in all Principal Cities.

H. W. PORTER & CO., Inc.
823-V Frelinghuysen Ave. Newark 5, N. J.

ANEMOTHERM *AIR METER*



MEASURES

AIR VELOCITY
FROM 10FPM to 6,000FPM

AIR TEMPERATURE
FROM 30F to 155F

STATIC PRESSURE
FROM 0 TO 4 NEG. AND FROM 0 TO 10 POS. IN. WG

This precision instrument gives vital data on the performance and efficiency of heating, ventilating and air conditioning systems. Direct, instantaneous readings.

SEND FOR FREE 4-PAGE FOLDER

Anemostat Corporation of America, Dept. TH-21
10 East 39 Street, New York 16, N. Y.

☐ Please send new 4-page folder on the Anemotherm Air Meter.
☐ I would like to have the Anemotherm demonstrated.

Name .....
Company .....
Address .....

AC 1231

NEW CATALOGS

Boilers

A 6-page folder features the series FD oil- and gas-fired Federal boilers for junior commercial and heavy commercial requirements and the series FC stoker, oil- and gas-fired units for residential use. A three-color cross-section shows the outstanding construction features of both boilers. The folder has tables on ratings and specifications for both FC and FD boilers.—*Federal Boiler Co., Inc., Granite and West Streets, Midland Park, N. J.*

Item 271

Thermostats

A new bulletin describes Stevens Type R bi-metal strip thermostats for use in appliances, industrial apparatus and electronic equipment. Illustrations include a schematic diagram of the operating principle, typical thermostat response curve, cutaway view of unit and photograph showing various standard designs. —*Stevens Manufacturing Co., Inc., Mansfield, Ohio.*

Item 272

Gas-Fired Boilers

Gas boilers for steam, vapor, hot water and radiant panel heating systems, using manufactured, natural, or mixed gas, are described in GE bulletin PM 12-0002. Covering eight sizes of boilers, with AGA output ratings ranging from 76,800 to 345,600 Btu per hr, the bulletin includes a cutaway view, photographs of control and safety features, and dimensions, ratings, and specifications.—*Automatic Heating Division, General Electric Company, Bloomfield, N. J.*

Item 273

Centrifugal Blowers and Exhausters

Bulletin 120-B-14, 24 pages, in two colors, covers centrifugal blowers and exhausters. Design and construction features of single and multi-stage units, with illustrations of the various types, including cross-section, diagrams, curves, exploded views, etc., are included.—*Roots-Connersville Blower Corp., Connersville, Ind.*

Item 274

How to Recess Convectors

How convectors can be recessed is explained in an illustrated booklet, No. 1865, showing installation details. A wall section was built and a series of photographs taken in step-by-step sequence as the plaster, woodwork, finished flooring and draperies were added. —*The Trane Co., La Crosse, Wis.*

Item 275

Refinery Equipment

A new 20-page catalog features refinery equipment and includes photographs and information on BS&B heaters, separators, gas scrubbers, dehydrators, safwalks, safety heads, relief valves, vent valves and flame arrestor combinations, fuel vaporizers, storage tanks, chemical feeders, blow cases, mufflers, pipe half soles and special fabrication. Charts give capacities and specifications.—*Black, Sivalls & Bryson, Inc., 720 Delaware, Kansas City 6, Mo.*

Item 276

Electric Heaters

Electric unit heaters for industrial and commercial applications and electric room heaters for domestic use are described in two new bulletins, with installation diagrams, photographs, and rating tables. — *Electromode Corporation, 45 Crouch Street, Rochester 3, N. Y.*

Item 277

Stainless Steel Pumps

Stainless steel centrifugal pumps for handling corrosive liquids are described and illustrated in Bulletin 725-3, with sectional drawings, construction charts, performance curves, and specifications. — *Goulds Pumps, Inc., Seneca Falls, N. Y.*

Item 278

Gas-Fired Boiler

National Radiator Catalog No. 557, illustrates and describes the new "55" Series National gas boiler which is designed for steam, vapor or hot water heating in large residences, apartment buildings, stores, hotels, hospitals, schools, institutions, industrial structures and other major space heating installations. The series is manufactured in 32 sizes having AGA approved net ratings ranging from 1,195 to 9,690 sq ft of steam radiation and 1,910 to 15,505 sq ft of hot water radiation. The new line features cast iron sectional construction, compact proportions, a low water line (41½ inches) and unusual ease of cleaning. This new 4-page catalog presents pertinent specifications, ratings, dimensions, roughing-in data and engineering information.—*The National Radiator Co., Johnstown, Pa.*

Item 279

Paul Venturi-Ball Valves

Paul high-performance Venturi-Ball valves are described in a new 16-page, two-color, illustrated Bulletin No. 103, covering principle of operation and engineering data on the complete line, including whistle valves, bar stock valves, cast steel and stainless steel valves, and forged valves.—*Paul Valve Corp., 683 Third Ave., New York 17, N. Y.*

Item 280

Protective Snubber for Pressure Gages

Action of the Parker pressure gage snubber in protecting gages from line shocks and vibration while eliminating needle fluctuation for more accurate readings is described in Bulletin 380.—*The Parker Appliance Co., Cleveland, Ohio.*

Item 281

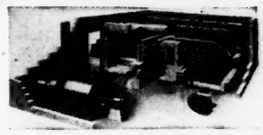
LEE DIRECT WARM AIR HEATING

Higher Efficiency! Greater Economy!

Direct warm air heating is fundamentally the most efficient means of transferring heat from fuel to air, and is especially suited to the heating of industrial buildings of all types, hangars, etc. Lee Engineering Company was one of the pioneers in this field, and today offers a complete line of both central system heaters and unit heaters. The Lee system gives heat WHEN needed and WHERE needed. It begins to distribute heat immediately after fire is lighted and fan started, responds promptly without lag. Air-flow is counter-current to flow of combustion gases, so that air becomes warmer as it extracts heat from the progressively hotter gases. Lower installation cost than steam or hot water; requires no licensed attendant; provides ventilation without additional cost. No expensive installation or maintenance of pipes, traps, valves, and pumps. Used with oil or gas, also with coal (stoker or hand-fired). Four main types illustrated here—send for Bulletin 10 with complete facts.

BRICK-SET TUBULAR HEATER

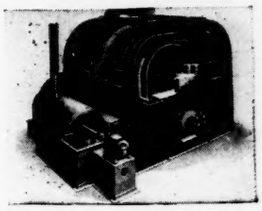
For use with central heating system (with duct distribution). Single heater capacities, 2,800,000 to 8,000,000 Btu per hour. Battery of two, operating as unit, provide over 10,000,000 Btu per hour.



Brick Set Tubular Heater

STEEL ENCASED TUBULAR HEATER

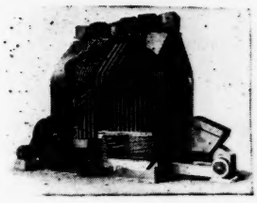
For use with central heating system (with duct distribution). Capacity range, 2,000,000 to 6,000,000 Btu per hour. May be installed in heated area without enclosure, requires no foundation. Unit may be moved by taking apart and reassembling.



Steel Encased Tubular Heater

TUBULAR UNIT HEATER

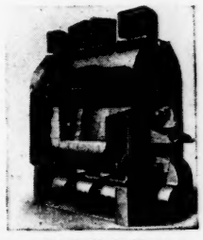
For use as central system (with duct distribution) or as unit heater, with adjustable outlet nozzles. Capacity range, 2,000,000 to 6,000,000 Btu per hour. In sizes up to 4,000,000 Btu, shipped completely assembled with all but mechanical equipment, refractory lining and controls in place. Requires no foundation. Equipped with crane hooks for moving.



Tubular Unit Heater

SHELL UNIT HEATER

For use with or without distributing duct system. Capacity range, 300,000 to 2,000,000 Btu per hour. Both hand- and stoker-fired models. All units shipped completely assembled, wired, ready for operation. Units furnished with either refractory lined or stainless steel combustion chambers. Heaters may be floor mounted or suspended in any position.



Shell Unit Heater

LEE ENGINEERING COMPANY

95 RIVER STREET • HOBOKEN, NEW JERSEY

(Formerly Youngstown, Ohio)

Use the Skidmore "CV" pump where space is limited . . . It's the outstanding vertical pump of the year. Small, compact and self-contained, the Skidmore "CV" Condensate Pump is carefully designed and precision made to give top performance and dependability. Capacities—500 to 10,000 sq. ft. E.D.R. Ask for it—Bulletin No. 21 HV gives the complete story.

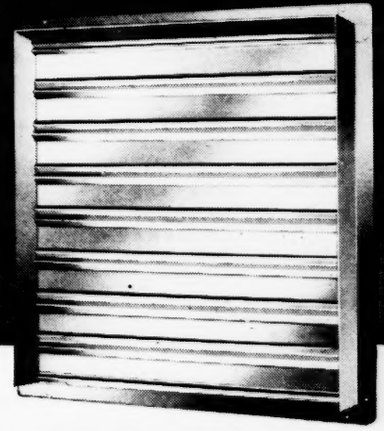
★ *See it at the Heating and Ventilating Show – January 23-27 – Dallas, Texas*

Skidmore Pumps

ST. JOSEPH, MICHIGAN

---

they all want **AIR-FLO**



MODEL A-555

THE AUTOMATIC SHUTTER WITH ALL THE FEATURES

Front View—Closed

IT TAKES THE LOAD OFF THE FAN!

Aluminum louvers open fully, permitting capacity fan operation. New heavy reinforcement strip adds strength and long life to the louvers, assures quiet operation and perfect counterbalance, prevents rattling. Deep shroud protects shutter from high winds. Tie-rod, brackets and bearings inside frame, not exposed to weather. Special finish resists corrosion. Many other features.

Write for New Air-Flo Catalog 43-F

Illustrations and details of the complete Air-Flo line.

AIR CONDITIONING PRODUCTS CO.

2340 W. LAFAYETTE BLVD. • DETROIT 16, MICH.

McCORD
HEATING AND
AIR CONDITIONING
PRODUCTS
COIL—AIR
CONDITIONING COILS—ALL TYPES
All copper spiral fin tube construction with the tubes formed or bent permits uniform expansion without strain. Headers are heavy wall construction with tubes brazed into extended ferrules formed in the headers. Fins are helically wound and metallically bonded. May we send catalog?
VERTICAL TYPE UNIT HEATERS
A proven heating unit, modern in design, incorporating every unit heater advancement. McCord copper spiral fin tube construction creates air turbulence without undue restriction. Improved fan blades deliver large volume of air with minimum air noise. Guaranteed for 150 lbs. saturated steam pressure. Specify McCord.
HORIZONTAL TYPE UNIT HEATERS
A time proven heating unit, modern streamlined in design, quiet, yet its rugged construction adapts it to all types of installations, guaranteed for use on No. 150 p.s.i. steam pressure. All copper heating element, individual spiral fin tubes free to expand without strain on joints. Standard motors with standard bases used. Wide range of capacities.
Save fuel with McCord Unit Heaters.
McCord CORPORATION
DETROIT 11, MICH.

School Ventilation

The Trane Unit Ventilator and its uses in schoolrooms are described in a new, four-color, 12-page sales catalog, Bulletin S-340. Photographs show this heating and ventilating unit installed in typical schoolrooms. A cutaway illustration shows the interior of the unit ventilator as well as its operation.—*The Trane Co., La Crosse, Wis.*

Item 282

Selection of Large A-C Generators

A new eight-page, two-color bulletin, 2200-PRD-196, tells in non-technical language the points to look for when ordering generators. Construction features and what these mean in terms of continuous, economical operation are pointed out and illustrated. Recent installations of large slow-speed engine-type generators are shown.—*Electric Machinery Mfg. Co., Minneapolis 13, Minn.*

Item 283

Industrial Thermometer Data

Data on liquid-in-glass industrial thermometers is presented in tabular and sectionalized form in the new Princo Bulletin E, 16 pages, two colors. Bulletin E has been designed as a reference guide incorporating all necessary information for both engineering and purchasing departments.—*Precision Thermometer and Instrument Co., 1507 Brandywine St., Philadelphia 30, Pa.*

Item 284

Industrial Spray Nozzles

The new line of Binks industrial spray nozzles is described in Bulletin 20. A table lists capacities in gallons per hour and gallons per minute for nozzles of each size at stated pressures from 5 to 100 lb per sq in. The table also gives such information as spray angles, orifice diameters, pipe sizes, etc. Exploded views and cutaway photographs show details of nozzle construction.—*Binks Mfg. Co., 3122 Carroll Ave., Chicago 12, Ill.*

Item 285

Flexible Metal Hose

Catalog 100 contains information relating to new uses for existing types of flexible metal hose; and development of new types of hose. Test tables, installation methods and applications are included — *Atlantic Metal Hose Co., 123 West 64th St., New York 23, N. Y.*

Item 286

Fitzgibbons Boiler

Fitzgibbons' bulletin on their "400" series steel boiler for residences and small buildings, describes the boiler with specifications and dimensions in tables and offers a full description and data on the Fitzgibbons Tank-

saver, a submerged copper coil for domestic hot water supply without the need of a storage tank.—*Fitzgibbons Boiler Co., Inc., 101 Park Avenue, New York 17. N. Y.*

Item 287

Fiberglas Duct Insulations

A 12-page publication contains design data for the application of Fiberglas duct insulating materials. Properties of the materials are described and a two-page, illustrated section provides a detailed description of field application procedure.—*Owens-Corning Fiberglas Corp., Toledo 1, Ohio.*

Item 288

Valves

Hammond valves for iron pipe and copper tubing are described in Bulletin No. 142, 8 pages, 4 colors. Steam and hot water radiator valves and union elbows, circulator valves, balancing elbows, check valves, fittings, and faucets are presented, with photographs, specifications and roughing-in dimensions. — *Hammond Brass Works, Hammond, Ind.*

Item 289

Multi-Vent Diffusers

Bulletin No. 395, 6 pages, explains the use of multi-vent panels for low velocity air diffusion. Photographs show how panels concealed behind metal acoustical ceilings handle both supply and return air. — *The Pyle-National Co., Multi-Vent Division, 1334 North Kostner Ave., Chicago 51, Ill.*

Item 290

Cooling Coils

Bulletin No. 49G, 32 pages, presents descriptions, photographs, specification tables and engineering data on fin coils for refrigeration, blast coolers, plate coils, ice cube makers and heat exchangers, etc. A section is included on estimating refrigeration loads.—*Peerless of America, Inc., 2901 Lawrence Ave., Chicago 25, Ill.*

Item 291

Liquid Level Controls

Catalog No. 1048, 30 pages, 3 colors, describes B/W all-electric floatless liquid level controls. Principles of operation are described, with installation diagrams and tables of specifications.—*B/W Controller Corporation, Birmingham, Mich.*

Item 292

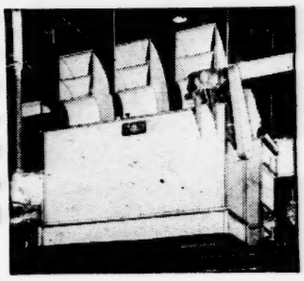
Industrial Heaters

Thermobloc industrial heaters are described in a 12-page bulletin as direct fired, floor mounted unit heaters with radial air delivery. Engineering data and tables for computing heating requirements and fuel consumption are contained in a separate 8-page folder.—*Thermobloc Division, Prat-Daniel Corp., East Port Chester, Conn.*

Item 293

New HIGH PRESSURE STEAM Fan Heater Gives Savings You Never Had Before

The first heater to make High Pressure Steam really trouble-free and practical in plant heating. Every engineer should understand its original method; write for Niagara Bulletin and performance data.



HOW IT OPERATES: —

Dual coil system uses both sensible and latent heat. High pressure steam enters upper coil, shown on diagram below. Condensate drains into a trap. Then this high pressure condensate is released into the header of lower coil, instantly flashing into steam at vapor pressure.

Any high pressure condensate that remains liquid is carried to vapor condensate return header by drain tube that also gives off its heat into air stream.

Vapor condenses in lower coil. Its condensate is kept at a high level in return leg by a wier in the return header and sub-cooled by contact with coldest air entering heater. Vacuum condensate return to boiler is vapor free.

HOW IT SAVES IN COST: —

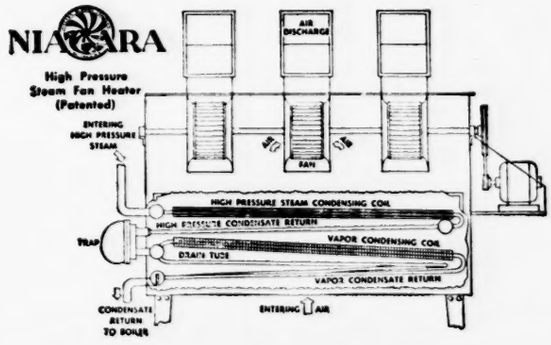
Piping is much smaller, simpler and less costly than in low pressure systems. Big traps and valves are not needed.

HOW IT SAVES IN OPERATION: —

Waste is prevented. Every BTU goes where you want it. No dump traps or hot wells waste live steam.

HOW IT SAVES IN UPKEEP: —

Condensate flow is even, vapor free, easily handled. No sudden surges of condensate in starting. No hammering, no hard wear and tear on system. Final air temperatures are not excessive; heat easily directed where needed; no flashing of low pressure condensate.



NIAGARA BLOWER COMPANY
Dept. HV
405 LEXINGTON AVE., NEW YORK 17, N. Y.

Please send Bulletin 109 on the Niagara High Pressure Steam Fan Heater.

Name .....

Address .....

plan to COME...

SEE
NEW PRODUCTS
GET
NEW IDEAS

Southwest Air Conditioning Exposition
STATE FAIR GROUNDS · DALLAS
JANUARY 23-27, 1950

Under Auspices of American Society of Heating and Ventilating Engineers

You'll certainly want to visit this great Exposition. It's an incomparable opportunity to learn about the latest developments in heating, ventilating and air conditioning for industrial plants, offices, homes . . . for buildings of every type.

More than 200 exhibitors and their technical staffs will be there to pass along new short-cuts to increased economy and efficiency in designing and applying air conditioning equipment. You'll come away with a mint of sound, practical IDEAS . . . IDEAS you might never get in any other way.

To conduct your own operations more profitably, you owe it to yourself to be fully informed . . . to have the latest data on every means of conditioning air. So, for profits and progress, plan definitely to attend.

Management International Exposition Company
Grand Central Palace, New York 17, N. Y.

Axial Flow Fans

Hunter Zephair fans, including belt driven, attic, window, ceiling, exhaust and oscillating fans, are described in an 8-page bulletin with sizing and specification tables.—*Hunter Fan & Ventilating Co., Inc., 400 South Front St., Memphis, Tenn.*

Item 294

Insulation Manual

Facts about heat transfer, vapor and vapor flow, condensation, radiant heating, and other information pertinent to the subject of insulation and insulation values are offered in a new edition of "Simplified Physics of Thermal Insulation," revised and expanded to 44 pages. The author, Alexander Schwartz, is president of Infra Insulation, Inc. Mr. Schwartz discusses every kind of material; mass fibrous insulation and reflective types; compares the various kinds of insulation, tells where and how to use them. The booklet contains the latest, specially compiled data on k, C, R, and U factors of all insulations, of all thicknesses, their densities, weights and cubic contents.—*Infra Insulation, Inc., 10 Murray St., New York 7, N. Y.*

Item 295

Tank Heating and Cooling

Tank heating and cooling is described and illustrated in a 6-page bulletin released by Kold-Hold. A direct comparison is made between the Platecoil and pipe coil methods of heat exchange. Ten advantages of Platecoil are described in relation to savings in time, money and manpower. — *Kold-Hold Manufacturing Co., Lansing, Mich.*

Item 296

Square Diffuser

A 4-page folder (Bulletin 29) explains the performance and application of the new square Type E aspirating Anemostat air diffuser. Photos illustrate how the square outlet provides diffusion over a full 360° arc with the same efficiency as a circular unit. Also, how it offers a wide variety of air distribution patterns by use of equalizing deflectors. Sizing and rating tables are included.—*Anemostat Corp. of America, 10 E. 39th St., New York 16, N. Y.*

Item 297

DECEMBER, 1949

TO OBTAIN COPIES OF TRADE LITERATURE listed in this issue, circle on the list below the publication wanted, using item number at the end of each review. Print your name and address, mail to

Editor, HEATING AND VENTILATING,
148 Lafayette Street, New York 13, N. Y.

271	272	273	274	275	276	277	278
279	280	281	282	283	284	285	286
287	288	289	290	291	292	293	294
295	296	297					

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WHAT READERS SAY

Exchange Arrangement

EDITOR, HEATING AND VENTILATING:

We are a firm in the line of ventilation, heating and air conditioning plants in Italy more than thirty years and are highly regarded in the market.

We should like to come to an agreement with some American concern in our line with a view to developing our plants. For this purpose we should like to have the son of our Principal—candidate for a degree in engineering—go over to America for an exchange of technical views and for taking cognizance of American systems in the field of construction and use of ventilation and air conditioning.

On our part we should be glad to give hospitality in our workshop to one of your technicians—should you think this fit—who may desire to study our market and the Italian principles.

Is it possible for you to place us into contact with some American concern who might be interested in our problem?

Milan, Italy *"Termonova"*

We will be glad to place any interested American concern in touch with the correspondent.—*Editor*

Getting Personal

S. L. Pappas

S. L. Pappas (co-author, *Heat Transfer of Buried Pipe in Clay or Sand*, page 85) was born in Birmingham, Alabama. He was graduated from the University of Alabama with a B.S. in Mechanical Engineering in 1943. After graduation he entered the army and served for two and one-half years in the Combat Engineers. In 1946 he started his postgraduate work at the University of Alabama and also taught in the department of mechanical engineering. He received his M.S. in engineering in 1947. He was employed by the Continental Gin Co. of Birmingham in 1947 and was engaged in the design and development of cotton ginning machinery until early 1948, when he accepted a position as research engineer with the Southern Research Institute of Birmingham. At the Institute he has been working on various phases of the heat pump problem, with special emphasis on heat sources. Mr. Pappas is also a part-time instructor in the department of mechanical engineering at the University of Alabama, Birmingham center. This is his second publication on the heat pump.

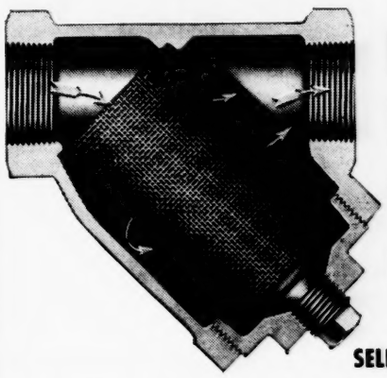
C. R. Freberg (co-author, *Heat Transfer of Buried Pipe in Clay or Sand*, page 85) is known to H&V readers as author of a *Progress Report on Heat Transfer Tests of a Buried Copper Pipe*, which appeared in the March, 1948 issue. His biographical sketch was published at that time. He has since left Southern Research Institute and is with the U. S. Naval Civil Engineering Laboratory, Solomons, Maryland.

McALEAR

DEPENDABLE PRESSURE REGULATION

McALEAR NO. 175
PRESSURE REDUCING REGULATOR

Here's accurate, dependable regulation for any application involving reduced pressures in the range from partial vacuum to 15 pounds per square inch gauge pressure. Double seated construction gives sensitive control. Other valves can be furnished with single seated construction or with spring adjustment in place of lever and weight for higher pressures. Sizes range from ½" to 20". Write for bulletin No. 119.



DEPENDABLE PIPING SYSTEM PROTECTION

McALEAR NO. 530
SELF-CLEANING "Y" STRAINER

Protection of pumps, valves, meters and other equipment calls for strainers wherever danger exists from sand, scale or pipe cuttings. Available in *any* size and *any* material . . . in either "Y" or basket type . . . McAlear strainers mean longer life for expensive equipment, fewer shut-downs and fewer repairs. Ask for bulletin No. 128.

McALEAR Mfg. Co.
1913 SOUTH WESTERN AVENUE
CHICAGO 8, ILLINOIS

McALEAR controls
for STEAM WATER AIR OIL-GAS

REPRESENTATIVES IN PRINCIPAL CITIES

AN INDEPENDENT MANUFACTURER FOR OVER 40 YEARS

Specify D.I.P.
REG. U. S. PAT. OFF.
for
UNDERGROUND
or EXPOSED
PIPING

Pre-Sealed and Ready for Installation

Wherever permanent protection against corrision and electrolysis are important factors in conveyance of Steam, Hot Water or Refrigerants, DURANT INSULATED PIPE is specified by architects, engineers, and contractors who want to keep installation and maintenance costs at a minimum for both underground and exposed piping.

Complete information is available through our representatives in principal cities, or we will be glad to send you complete catalog information on standard piping units and our complete line of special fittings to meet all requirements.

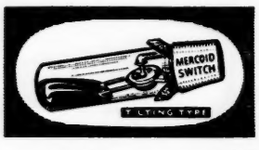
PRE SEALED
REG. U. S. PAT. OFF.

DURANT INSULATED PIPE COMPANY
1015 Runnymede St. East Palo Alto, California

MERCOID

AUTOMATIC CONTROLS FOR HEATING, AIR CONDITIONING, REFRIGERATION AND VARIOUS INDUSTRIAL APPLICATIONS

THE ONLY 100% MERCURY SWITCH EQUIPPED CONTROLS



The distinguishing feature of Mercoid Controls is the exclusive use of Mercoid hermetically sealed mercury switches. These switches are not subject to dust, dirt or corrosion, thereby assuring better performance and longer control life. The items shown below are but a few miscellaneous items. See Catalog No. 700 for the complete line.

Pressure Controls

Temperature Controls

Float Operated Controls

Transformer-Relays

Low Voltage Thermostats

Line Voltage Thermostats

Liquid Level Control

Oil Burner Safety and Ignition Controls

If you have a problem involving the automatic control of pressure, temperature, liquid level, mechanical operations, etc., it will pay you to consult Mercoid's engineering staff — always at your service.

Manufacturers of Dependable Automatic Controls for Over A Quarter of A Century

THE MERCOID CORPORATION · 4223 BELMONT AVE. CHICAGO 41 · ILL.

William N. Witheridge (*Foundry Cupola Dust Collection*, page 69) is a native of Saginaw, Michigan. Prior to entering Michigan State College he attended the General Motors Institute for Industrial Engineering and was employed by General Motors at the Crankshaft and Oldsmobile Divisions continuously from 1927 to 1936. During this period he obtained his B.S. in mechanical engineering from Michigan State College in 1935. He took his master's degree in sanitary engineering at Harvard University in 1937 and became chief engineer of the Bureau of Industrial Hygiene in the Detroit Department of Health in 1937. In 1941 he become director of the bureau. He received a master's degree in public health engineering from the University of Michigan in 1946 and since that time has been ventilation consultant to the General Motors Corporation. During the war he conducted war training courses in air sanitation and industrial ventilation for the University of Michigan. He has published about 20 articles on industrial ventilation, air cleaning and air conditioning and has contributed chapters to textbooks on such subjects as air contaminants, environmental factors in fatigue and competence, and ventilation. He is the author of two books: *Air Sanitation and Industrial Ventilation* and *Odors: Physiology and Control* (with C. P. McCord). He holds membership in five professional societies and he has held important committee and administrative positions in each.

W. N. Witheridge

. . . Since the Last Issue

A number of personnel changes, including new regional, branch and division managerships, have been announced by the **Minneapolis-Honeywell Regulator Co. Kent L. Wilson** has been named manager of the company's newly formed manufacturers' division. He will assist A. H. Lockrae, vice president in charge of the heating controls division and will be concerned primarily with manufacturers of heating equipment. Mr. Wilson, an engineering graduate of the University of Minnesota, joined Honeywell as a student engineer in 1935, served as sales engineer in Philadelphia and Indianapolis, and in 1941 was promoted to industrial sales manager in Cleveland. In 1944 he was made Detroit branch manager, and in 1948 was named southwestern regional manager with headquarters in Dallas, a position be held until his latest promotion. **T. S. Carley,** who has been Detroit branch manager, will succeed Mr. Wilson as head of the Honeywell-Brown office in Dallas. Mr. Carley joined Honeywell in 1935 in the production department as an apprentice. **Karl Schick,** former southwestern regional manager, is rejoining M-H after a year as a distributor for several companies in the Dallas area. He will be sales manager of the company's gas controls division. **J. A. DePuy** has been promoted to managership of the Detroit office, succeeding Mr. Carley. Mr. DePuy is a graduate of Union College and worked for General Electric and the York Ice Machine Company before joining Honeywell's New York office as an instrument engineer in 1936. **Jack Richardson,** who has been manager of the industrial division's sales department in Detroit, will succeed Mr. DePuy as the Cincinnati Honeywell-Brown branch manager. **James Dunlap,** who has been with the Toledo office, has been named industrial division sales manager in Detroit, and **Harry Merkel,** of the Pittsburgh branch office, has been transferred to Toledo in charge of industrial sales.

Transfer of water cooler manufacturing operations of the **General Electric Co.'s** Air Conditioning Department from Bowling Green, Ky. to Bloomfield, N. J., has been announced.

Clayton P. Yoder has been appointed sales manager of the Platecoil Division of the **Kold-Hold Manufacturing Co.** Mr. Yoder's immediate activities will include establishing sales representatives in the leading industrial areas of the country. He will have charge of training personnel and general promotion of the products of the Platecoil division.

Thomas M. Cunningham has been appointed to the staff of **Heating, Piping and Air Conditioning Contractors' Chicago Association.** Mr. Cunningham will become executive secretary of the association upon the retirement of Louis T. Braun next July 1. Mr. Cunningham is coming to Chicago from Syracuse, N. Y., where he has been director of industrial relations for Carrier Corp. He was with the air conditioning-refrigeration company 25 years.

Mitchell Manufacturing Co., Chicago, Ill., has announced the appointment of **E. A. Tracey** as vice president of the corporation and general manager of the Air Conditioning Division. Prior to his present association, Mr. Tracey was president of the Majestic Radio & Television Corp. and vice president in charge of sales of the Zenith Radio Corp.

Bernard Lester, an employee of Westinghouse for 42 years and recipient of the Westinghouse Order of Merit in 1941, **John A. Silver,** and **Frank W. Hankins** have announced the formation of the management engineering firm of **Lester, Hankins and Silver.** Specializing in the management, distribution and sales problems of manufacturers and distributors of machinery, equipment and technical products, the company has offices at 1605 Race St., Philadelphia, and 140 Cedar St., New York.

The **American Welding Society** has elected **O. B. J. Fraser,** assistant manager, Development and Research Division, The International Nickel Company, Inc., New York, as its president for the year 1949-50.

The appointment of **G. K. Iwashita** as manager of product planning of the **General Electric Co.'s** Air Conditioning Department has been announced. Prior to his appointment, Mr. Iwashita was manager of product research of the Seeger Sunbeam Corp., Evansville, Indiana. He served as a Major in the Intelligence Service of the U. S. Army from 1942 to 1947.

A. F. Zissler has been elected executive vice president and general manager of **The Peerless Electric Co.,** Warren, Ohio. A graduate of the engineering college of Iowa State University, Mr. Zissler has represented Peerless motors, fans and blowers in the Rochester, New York, territory for the last eleven years but will now make his headquarters in Warren, Ohio.

A. B. Meeg

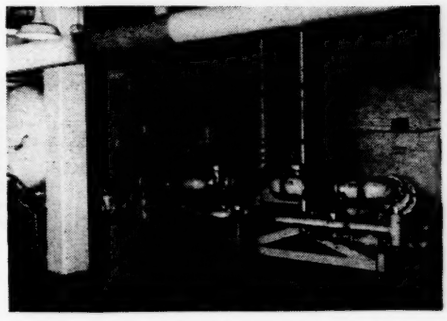
Bell & Gossett Co., Morton Grove, Ill., announces the appointment of **A. B. Meeg** as manager of national accounts. Mr. Meeg was graduated in mechanical engineering by the University of North Dakota and later completed the apprentice course in power plant equipment engineering with the Westinghouse Electric & Manufacturing Co. He served from 1926 to 1929 as field engineer for Westinghouse in the Chicago and Midwest area. In 1930, Mr. Meeg joined the Iron Fireman Mfg. Company organization and served in the Chicago branch area as mechanical superintendent, industrial salesman and manager of National Accounts Division. In 1948 he joined the Perfex Corporation of Milwaukee, Wisconsin, as manager of the Industrial Control Division.

Food Machinery and Chemical Corp. announced the appointment of **Gerald F. Twist** as manager of the firm's **Peerless Pump Division** with headquarters at Los Angeles.

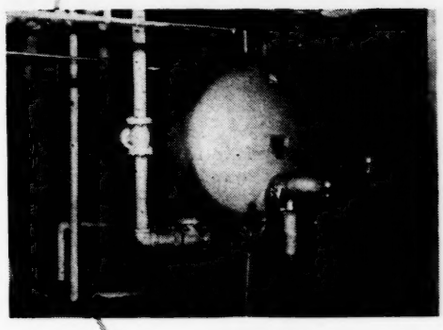
The SHAMROCK

America's Magnificent Hotel and Patterson-Kelley

Wyatt C. Hedrick, Architect & Engineer
Stone & Webster Engineering Corp., Construction Managers



Clean, uniform hot water for all guests on the eighteen floors comes from two of these 1400 gallon Patterson Type B Hot Water Storage Heaters. The third heater is the Booster for laundry hot water service.



And this is the large 880 gallon Patterson Type B Hot Water Heater serving the kitchen.

USES

And there are other Patterson-Kelley Heaters for laundry and other services. It's significant that for such an impressive and important project as the Shamrock — America's Magnificent Hotel — Patterson Kelley Hot Water Heaters were selected. You will certainly be getting the best when you select a Patterson-Kelley Hot Water Storage Heater for your next project.

These informative catalogs available upon request:
Copper Lined Heaters
Copper Silicon Heaters
Patterson Type B Heaters
Write today for catalogs desired.

the P
Patterson-Kelley Co., Inc.

95 Burson Street • East Stroudsburg, Penna.

Offices or Representatives in Principal Cities

SEE— for yourself

How a fast-running repair job is done in an old hotel

You can do more work every day when you bend pipe with a

TAL Portable Bender

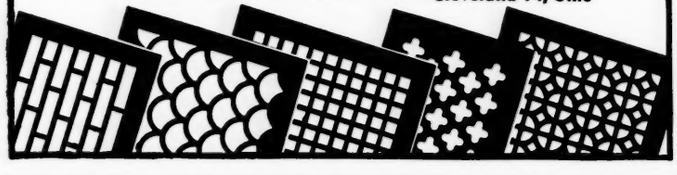
Work goes faster when you bend on the job — either original installation, radiant heat or repair. Fewer joints to leak in the future, less friction, more satisfaction for your customers and a bigger profit for you. Do as hundreds everywhere are already doing. Write for illustrated data bulletin. Dept. 12.

Tal Bender, Inc. Milwaukee 2, Wisconsin

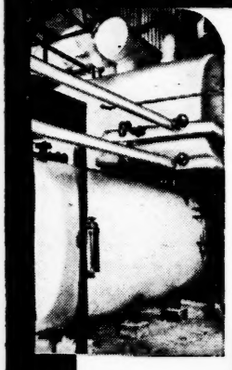
Auer GRILLES

Stamped metal grilles in many designs, sizes to order, for all purposes—air conditioning, ventilating, radiator enclosure, or concealment. In steel (or stainless), aluminum, brass, or bronze. Finished in prime, or special finishes or platings. Catalog "G" shows all designs, with dimensions, opening sizes, full scale details. Sent on request.

THE AUER REGISTER COMPANY 3608 Payne Ave., Cleveland 14, Ohio



HERE'S YOUR COVER FINISH



No need to sew covers onto insulation. Cementing saves time, costs less. Arabol Lagging Adhesive—developed for war needs—now meets all requirements on installations of all sizes. Easily applied, dries quickly, requires no painting. Write for Bulletin #14.

THE ARABOL MANUFACTURING CO.
110 East 42nd St., New York 17, N. Y.
1835 S. 54th Ave., Chicago 50, Ill.
1950 16th St., San Francisco 3, Cal.

Adhesives?... ARABOL!

The Lunkenheimer Co. announces the appointment of **Paul M. Arnall** as vice president and general manager. Mr. Arnall will assume his new position January 3. A native of Elk Falls, Kansas, he was educated at the University of Kansas and has had wide experience in the industrial field. With the Graton & Knight Co., Worcester, Mass., he rose to assistant general sales manager. He then became associated with The Ohio Injector Co., Wadsworth, Ohio, as sales manager and for the past several years has been executive vice president and director. After January 3, Lunkenheimer manager organization will consist of Frank P. Rhame, president; Paul M. Arnall, vice president and general manager; Homer E. Lunken, vice president and assistant general manager; Harry A. Burdorf, vice president for sales; Edmund P. Lunken, vice president; Chester C. Isekeit, treasurer; Charles W. Burrage, secretary.

P. M. Arnall

Harry J. Deines, of New York, an advertising executive with nearly twenty years of experience in the electrical manufacturing field, has been named manager of advertising and sales promotion for the **Westinghouse Electric Corp.,** Pittsburgh, Pa. Mr. Deines is a native of Loveland, Colorado, and was graduated from the University of Colorado in 1930 with the degree of Bachelor of Science in mechanical engineering. Immediately after his graduation he joined the General Electric Co., working first on engineering tests of electric equipment. In 1932 he was assigned to advertising and sales promotion activities in apparatus, electronics and radio and continued in that line until 1944. He joined the Arthur Kudner advertising agency in 1944 as an account executive. Later that same year he became account executive and vice president of the Fuller & Smith & Ross, Inc., advertising agency and since that time has been closely associated with advertising programs for Westinghouse products.

Fairbanks, Morse & Co., announce the appointment of **A. C. Traub** as manager of their stoker division with headquarters in Chicago. He succeeds **F. J. Kluempers** who has been transferred to the general dealer sales division. Mr. Traub joined the Fairbanks-Morse organization in 1937 as sales promotion manager of the company's Cincinnati branch. Later, in 1941, he became manager of the dealer department of the same branch. In 1947 he was transferred to Los Angeles where he was manager of dealer sales, which position he left to take his present assignment in the stoker division.

William F. Ryan and **James D. Ryan** have organized the **Ryan Engineering Co.,** 114½ West Iron St., Salina, Kansas, consulting engineers specializing in heating, ventilating, air conditioning and piping.

Marshall F. Allen has been appointed manager of **The Magnesia Insulation Manufacturers Association** succeeding Utley W. Smith, who resigned to accept a position with Ehret Magnesia Manufacturing Co. Mr. Allen's headquarters will be at the association offices in Washington, D. C. Mr. Allen was formerly executive secretary of the National Aircrafts Standards Committee, a subsidiary of the Aircraft Industries Association. He has been engaged in trade association and government work in Washington since 1940. During the war, he was associated with the British and Australian governments here and also served with the U. S. Army Air Forces. He attended William and Mary College, and received his engineering degree from Johns Hopkins University.

M. F. Allen

General Controls, Glendale, California, manufacturers of automatic, pressure, temperature, level and flow controls, has announced the opening of new factory branch office facilities in Minneapolis, Buffalo and Baltimore. Named as branch managers in the newly opened offices are **R. Roger Rosell, Jr.,** Minneapolis; **Paul A. Palmgren,** Buffalo, and **Fred H. Angier** at Baltimore.

The appointment of **Francis B. Dunn** as manager of the Houston works of the **A. O. Smith Corp.** has been announced. **C. W. Wheatley,** who has been assigned temporarily to the task of building up the postwar management of the Houston works, has returned to the company's Milwaukee headquarters where he will resume his work on the general staff.

R. J. Hamilton

Rolland J. Hamilton retired as vice president of the **American Radiator & Standard Sanitary Corp.,** November 1. Mr. Hamilton will continue to serve the corporation on its board of directors and on the executive committee. He has been in the employ of American-Standard and its predecessor, American Radiator, for almost 45 years, and served in various executive capacities for most of that time. He joined the American Radiator Co. in 1905 as secretary to the executive committee, and, after four years, was promoted to assistant secretary.

Yarnall-Waring Co., Philadelphia, announces the following appointments in its sales organization: **John A. Steer,** formerly district manager of Philadelphia territory, has been appointed New York district manager, succeeding **Harold S. Webster,** who has retired. **J. B. Ambler** has been appointed sales representative in the Denver district. Numerous additions have been made in the Yarway list of steam trap distributors.

Election of **A. T. Waidelich** as vice president in charge of research for **The Austin Co.** has been announced. Mr. Waidelich joined the Austin organization as a structural designer in its New York district offices in 1936, and has been assistant director of research at the company's headquarters in Cleveland since 1941.

The appointment of **J. L. Lessman** as manager of valve and fitting sales for **The Cooper Alloy Foundry Co.,** Hillside, N. J., has been announced.

H. D. McAneny

Harold D. McAneny has been appointed director of advertising by **Richmond Radiator Co., Inc.,** an affiliate of Reynolds Metals Co., manufacturers of plumbing and heating equipment. He will make his headquarters at the company's New York office. Mr. McAneny was formerly an account executive with Morris F. Swaney, Inc., and prior to that connection his experience included similar work with Henry A. Loudon, and Arthur Kudner, Inc.

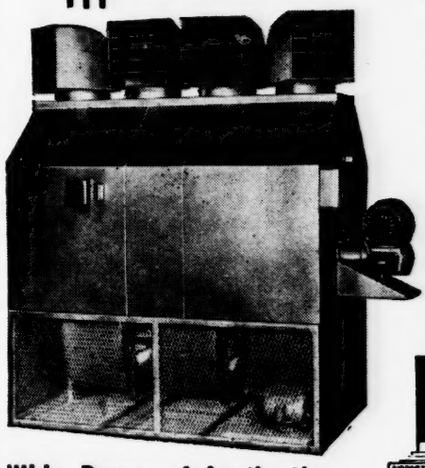
Ruud Manufacturing Co., Pittsburgh, Pa., has purchased a new, modern factory in Toronto, Ont. The new plant will have twice the floor space of the present Toronto factory which has been in continuous operation for over forty years as a direct operation of the Pittsburgh company.

The appointment of **F. P. Taugher** as manager of engineering for the **Westinghouse Electric Corp.'s** Industrial Control Division, Buffalo, N. Y., was recently announced. Mr. Taugher has been engineering and service manager in the company's New England district for the past five years.

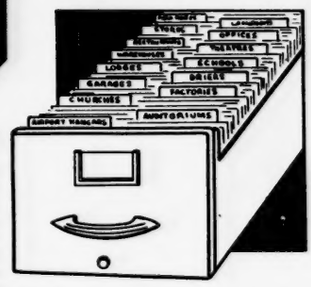
NATIONAL CHAMPION

HEAVY DUTY FORCED AIR UNITS FOR LARGE SPACE HEATING REQUIREMENTS

GAS and OIL BURNING DIRECT FIRED UNIT



A self-contained unit with adjustable discharge heads for positive heat delivery in any direction. Streamlined fire box of high heat and corrosion resisting Type 310 Stainless Steel insures a far longer life of service and satisfaction. Tear Drop combustion chamber design and convector tube arrangement affords complete efficient air wipage of all heating surface at minimum resistance. Available in models for central heating systems employing supply and return ducts.



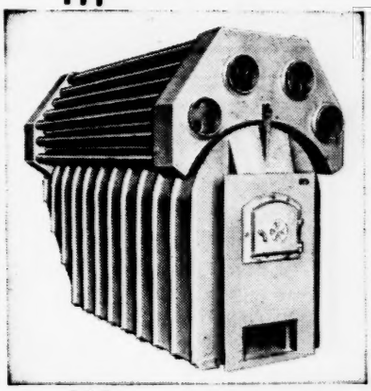
Wide Range of Applications

These units have proven practical and economical for most types of public, commercial and industrial buildings. National Champion heaters are the product of over a half century of experience in this field and the latest advanced engineering features of these units have been tested in a rapidly increasing range of actual installations.

GENERAL CAPACITY DATA

Model Number	Btu	Cfm	hp	Dimensions (inches) length-width-height			Approximate Shipping Wt., Lbs.
T.D.— 25	250,000	3,600	¾	60	32	81	1,300
T.D.— 40	400,000	5,400	1	60	32	81	1,350
T.D.— 50	500,000	6,600	1½	80	32	81	1,780
T.D.— 70	750,000	8,800	2	80	32	81	1,855
T.D.— 80	800,000	10,200	3	80	48	81	2,110
T.D.—100	1,000,000	12,500	5	80	48	81	2,200
T.D.—125	1,250,000	15,300	5	100	54	103	3,000
T.D.—150	1,500,000	19,400	7½	100	54	103	3,250

NATIONAL HEATER COAL FIRED FORCED AIR UNIT

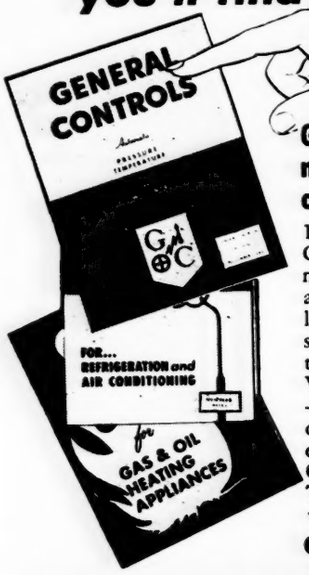


Specifically constructed and designed for stoker and hand firing with blower position at rear of casing, this unit embodies all the features of other NATIONAL heaters for greater satisfaction and economy of operation. Can be quickly and efficiently converted to light oil, heavy oil or gas firing as future fuel costs and supplies may necessitate.

• *Write for Literature*

NATIONAL HEATER CO.
CLEORA & VANDALIA STREETS
ST. PAUL 4, MINNESOTA

when the call is for
CONTROLS
you'll find the answer
HERE



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104 pages covering the *complete* General Controls line of Automatic Pressure, Temperature, Level and Flow controls. It charts, tabulates and details, capacities, pressures, dimensions and specifications of hundreds of controls. Whatever the product or process—in heating, refrigeration, aircraft or industry, there's a *better* General Control for the job. General Controls *do* more and cost *less*. The new Catalog tells how and why. Send for your copy today.

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802 Allen Ave., Glendale 1, Calif.

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Automatic Pressure, Temperature, Level and Flow Controls
FACTORY BRANCHES: Baltimore (5), Birmingham (3), Boston (16), Buffalo (3), Chicago (5), Cincinnati (2), Cleveland (15), Dallas (1), Denver (4), Detroit (8), Glendale (1), Houston (6), Kansas City (2), New York (17), Minneapolis (2), Philadelphia (40), Pittsburgh (22), San Francisco (7), Seattle (1), St. Louis (12), Tulsa (6).
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POWER DRIVEN ROOF EXHAUSTER

For stores, cafes, bakeries, laundries, garages, etc. Built to function in wet air—motor is out of line of air flow. A compact, sturdy, easy-to-install package unit. Sizes 370 to 13,080 C.F.M. air delivery. Fits any roof. *Write us about YOUR problem.*

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SHALLO-WELL
OIL-FIRED FLOOR FURNACES
ONLY **34** INCHES DEEP
BTU CAPACITIES OF
★ 50,000 ★ 65,000 ★ 75,000
Write for Details!
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INDUSTRIAL DEGREE-DAYS
September and October, 1949

City	Number of Industrial Degree-Days			
	55F Base		45F Base	
	September	October	September	October
Baltimore, Md.	0	12	0	0
Buffalo, N. Y.	31	75	0	8
Chicago, Ill.	15	70	0	10
Cleveland, Ohio	21	59	0	4
Detroit, Mich.	25	75	0	14
Indianapolis, Ind.	17	62	0	9
New York, N. Y.	0	11	0	0
Philadelphia, Pa.	0	11	0	0
Pittsburgh, Pa.	16	36	0	0
St. Louis, Mo.	2	52	0	9

Canadian Degree-Days for September and October, 1949

City	September		October	
	1949	Normal	1949	Normal
Calgary, Alta.	320	432	840	722
Charlottetown, P.E.I.	232	222	477	539
Crescent Valley, B. C.	340	360	772	648
Edmonton, Alta.	369	444	846	747
Fort William, Ont.	440	354	642	722
Grand Prairie, Alta.	393	480	852	812
Halifax, N. S.	158	189	420	499
London, Ont.	263	126	366	508
Medicine Hat, Alta.	241	267	725	601
Moncton, N. B.	257	282	511	595
Montreal, P. Q.	224	180	421	561
North Bay, Ont.	412	264	518	694
Ottawa, Ont.	282	204	440	595
Penticton, B. C.	227	213	623	527
Porquis Junction, Ont.	474	396	614	800
Prince George, B. C.	456	444	831	741
Quebec City, P. Q.	248	276	456	651
Regina, Sask.	393	408	843	794
St. John, N. B.	214	270	440	558
Saskatoon, Sask.	362	396	887	781
Toronto, Ont.	211	168	313	504
Vancouver, B. C.	186	234	561	459
Victoria, B. C.	189	264	496	446
Windsor, Ont.	214	54	251	425
Winnipeg, Man.	347	330	735	744

*These data are supplied through the courtesy of the Meteorological Division, Air Service Branch, Department of Transport, Canada.

COMING EVENTS

Where listed, names or titles of individuals are those from whom further information is available.

METEOROLOGICAL MEETING—30th anniversary meeting of The American Meteorological Society, at St. Louis, Mo. Details to be announced later. Executive secretary, 5 Joy St., Boston 8, Mass. ..... **JANUARY 4-6, 1950.**

AUTOMOTIVE ENGINEERS MEETING — SAE 1950 annual meeting of the Society of Automotive Engineers, Hotel Book-Cadillac, Detroit, Mich. John A. C. Warner, secretary, 29 W. 39th St., New York 18, N. Y. ..... **JANUARY 9-13, 1950.**

PLANT MAINTENANCE SHOW AND CONFERENCE — First plant maintenance show and conference sponsored by American Society of Mechanical Engineers and Society for Advancement of Management, in the Auditorium, Cleveland, Ohio. Clapp & Poliak, Inc., 350 Fifth Ave., New York 1, N. Y., exposition management. ..... **JANUARY 16-19, 1950.**

HEATING AND VENTILATING MEETING—56th annual meeting of the American Society of Heating and Ventilating Engineers, at Dallas, Tex. A. V. Hutchinson, secretary, 51 Madison Ave., New York 10, N. Y. ....**JANUARY 23-26, 1950.**

HEATING AND VENTILATING SHOW—Southwest Air Conditioning Exposition of the International Heating and Ventilating Exposition, State Fair Grounds, Dallas, Texas, under the auspices of the American Society of Heating and Ventilating Engineers. Charles F. Roth, manager of the International Exposition Company, Grand Central Palace, New York 17, N. Y. .....**JANUARY 23-27, 1950.**

ENGINEERING SOCIETIES EXPOSITION—5th annual engineering exposition of the Minnesota Federation of Engineering Societies, at Minneapolis Armory, Minneapolis, Minn. Show manager, Brede Inc., 1720 New Brighton Blvd., Minneapolis 13, Minn. .....**FEBRUARY 21-23, 1950.**

CONTRACTORS CONVENTION—1950 convention of The Associated General Contractors of America, Inc., at San Francisco, Calif. Wm. G. Dooly, Jr., staff member, Munsey Building, Washington 4, D. C. .....**FEBRUARY 27-MARCH 2, 1950.**

MATERIALS MEETING—Spring meeting of the American Society for Testing Materials, at Hotel William Penn, Pittsburgh, Pa. Secretary of Society, 1916 Race St., Philadelphia 3, Pa. .....**FEBRUARY 27-MARCH 3, 1950.**

CORROSION ENGINEERS CONFERENCE—6th annual conference of the National Association of Corrosion Engineers, at St. Louis, Mo. Secretary of Association, 919 Milam Bldg., Houston 2, Tex. .....**APRIL 4-7, 1950.**

POWER CONFERENCE—12th annual Midwest Power Conference, sponsored by Illinois Institute of Technology, at Hotel Sherman, Chicago. Conference director, Roland A. Budenholzer, at Illinois Tech, 3300 S. Federal St., Chicago 16, Ill. .....**APRIL 5-7, 1950.**

ASME MEETING—Spring meeting of the American Society of Mechanical Engineers, at Hotel Statler, Washington, D. C. C. E. Davies, secretary, 29 W. 39th St., New York 18, N. Y. .....**APRIL 12-14, 1950.**

OIL HEAT EXPOSITION — National Oil Heat Exposition, in conjunction with the 27th annual convention of Oil-Heat Institute of America, at Commercial Museum, Philadelphia, Pa. C. F. Curtin, secretary, 6 E. 39th St., New York 16, N. Y. .....**WEEK OF APRIL 24, 1950.**

PROCESS INDUSTRIES CONFERENCE—Process Industries Division Conference of the American Society of Mechanical Engineers, at William Penn Hotel, Pittsburgh, Pa. C. E. Davies, secretary, 29 W. 39th St., New York 18, N. Y. .....**APRIL 24-26, 1950.**

SHEET METAL CONVENTION—Annual convention of Sheet Metal Contractors Association of Illinois, Inc., at State Armory Building, Springfield, Ill. Geo. L. Folkers, convention chairman, 709 S. Adams St., Peoria, Ill. .....**APRIL 27-29, 1950.**

CONTRACTORS MEETING—1950 annual meeting of the Heating, Piping, and Air Conditioning Contractors National Association, at St. Francis Hotel, San Francisco, Calif. Secretary of Association, 1250 Avenue of the Americas, New York 20, N. Y. .....**MAY 8-12, 1950.**

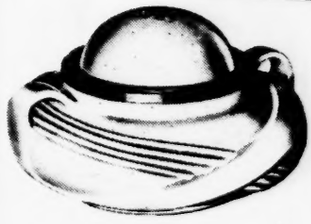
NDHA MEETING — 41st annual meeting, National District Heating Association, at Grove Park Inn, Asheville, N. C. John F. Collins, Jr., secretary of Association, 827 N. Euclid Ave., Pittsburgh 6, Pa. .....**MAY 23-26, 1950.**

ASME MEETING—Semi-annual meeting of the American Society of Mechanical Engineers, at Hotel Statler, St. Louis, Mo. C. E. Davies, secretary, 29 W. 39th St., New York 18, N. Y. .....**JUNE 19-23, 1950.**

INCREASED BUSINESS and PROFITS with Walton HUMIDIFIERS

YES, during the winter months when most homes are too dry, take advantage of the tremendous selling potential that is in the merchandising of Walton Humidifiers.

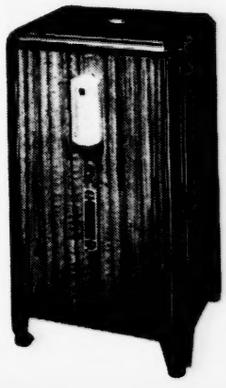
AVAILABLE IN TABLE MODELS
beautifully designed to meet the decor of any home.



POTTERY TABLE
evaporates 3 gallons water into the air per day. Available in pastel shades of blue or green.

BRONZE TABLE
evaporates 5 gallons of water into the air per day. Furnished with a rich statuary Bronze finish.

AUTOMATICALLY CONTROLLED CABINET MODELS



in a variety of rich grains. Shown here — single cabinet with walnut grain. Evaporates 5 gallons of water into the air per day.

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Write for a booklet on the complete residential and office line of Walton Humidifiers.

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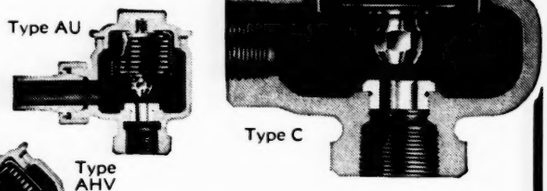
Information on the Walton Industrial and Commercial line also available.

WALTON LABORATORIES
IRVINGTON, NEW JERSEY

Nicholson Steam Traps

CUT Processing Time 30%

for Food Packer



Records of a recent installation of Nicholson steam traps, by a leading food packer, show they cut cooking time 30%. For example, one operation was shortened from 65 to 45 minutes. Nicholson units keep equipment full of live steam because: 1) they operate on lowest temperature differential; 2) have 2 to 6 times average drainage capacity. Also widely specified for preventing damage to thin gauges; eliminate cold blow in unit heaters; record low for steam waste; and maximum air-venting capacity. 5 types for every application; size ¼" to 2"; pressure to 225 lbs. BULLETIN 1047.

W. H. NICHOLSON & CO. 199 OREGON STREET WILKES-BARRE, PA.

Valves • *Traps* • *Steam Specialties*

ORIGINATORS OF

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CONTROLS FOR HEATING SYSTEMS

AU-TEMP-CO

MOTORIZED VALVES

INDOOR-OUTDOOR TEMPERATURE CONTROLS

Au-Temp-Co Corp., 521-5th Ave., N.Y.C.

An Authoritative Reference Book *for*

Heating Engineers—Estimators—Air Conditioning Engineers—Ventilating Engineers—Architects—Piping Engineers—Contractors—Plant Engineers—Operating and Maintenance Engineers

HEATING AND VENTILATING'S

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Write for Descriptive Folder to
HEATING AND VENTILATING, 148 Lafayette St., N. Y. 13

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Non-display advertisements 10 cents a word per insertion. (No charge for name and address.) Minimum charge $2.00. Payable in advance.

MANUFACTURERS' AGENTS WANTED

Experienced well established representatives for well known line of steel low pressure boilers, both residential and commercial types. Only those selling kindred lines will be considered. In reply please give full details of organization and lines handled. Box No. 675, HEATING and VENTILATING, 148 Lafayette St., New York 13, N. Y.

FOR SALE—Improved Elbow Edging and Cutting Machine—Chicago Elbow Machine Co.—No. 102, Serial 2, Type 1-15, furnished with ¾ H.P. Westinghouse Motor, 110-220, single phase, 60 cycle—1,725 R.P.M. Box No. 686, HEATING and VENTILATING, 148 Lafayette Street, New York 13, N. Y.

SECRETARY-STENOGRAPHER with several years' engineering experience, seeks good connection, New York City area. Capable handling general office routine. Box No. 685, HEATING and VENTILATING, 148 Lafayette Street, New York 13, N. Y.

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Reference Sections, Blueprints and Special Sections are now available as pamphlets, price 5 for $1; or 25 cents each.

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- Factors in the Design of Cyclone Dust Collectors
- Water Treatment for Heating and Air Conditioning
- Gas for Heating Large Buildings
- Progress Report on a Heat Pump Water Heater
- Check Valves in Piping
- Air Conditioning Retail Food Stores
- Residential Heat Pump in Various Climates for Summer and Winter Air Conditioning
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Send Order and Remittance to

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ARCHITECTURAL, ELECTRICAL, MECHANICAL, STRUCTURAL

Men for immediate permanent employment in drafting-room positions as job captains and squad leaders. Do not apply unless well qualified for work on building construction. State schooling, experience and salary expected.

LEO A. DALY COMPANY
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AIR CONDITIONING, HEATING, AND VENTILATING ENGINEER, GRADUATE, seeks position as assistant construction superintendent for contractor on medium and large air conditioning and heating projects. Thoroughly experienced design engineer, former head of design department, with some estimating, field, and maintenance experience. New York at present, will relocate. Box No. 688, HEATING and VENTILATING, 148 Lafayette Street, New York 13, N. Y.

FOR SALE — 1 Burnham Steel Boiler No. 66-119. Rating at Nozzle 21,250 sq. ft. of steam EDR. Boiler less than 3 years old, equipped with Ace Horizontal Rotary Oil Burner with high and low flame control. In excellent condition. Can be seen in operation at Hubeny Brothers, Inc., 615 East First Ave., Roselle, N. J. Price $2,000.00.

ENGINEER—14 years' experience in designing, specification writing, estimating and selling air conditioning, refrigeration, heating and ventilating equipment and systems. B. S. Registered. Interested in representing manufacturer in St. Louis. Will consider other work. Box No. 687, HEATING and VENTILATING, 148 Lafayette Street, New York 13, N. Y.

ALL-WEATHER ALUMINUM HOLDERS
All sizes for truck meter tickets. Keep drivers' tickets clean. Send sample of your ticket and we will furnish proper size holder.
DEGREE-DAY SYSTEMS, WOODSIDE, N. Y.

Sales notes from usAIRco Dealers . . .

MODU-AIRE

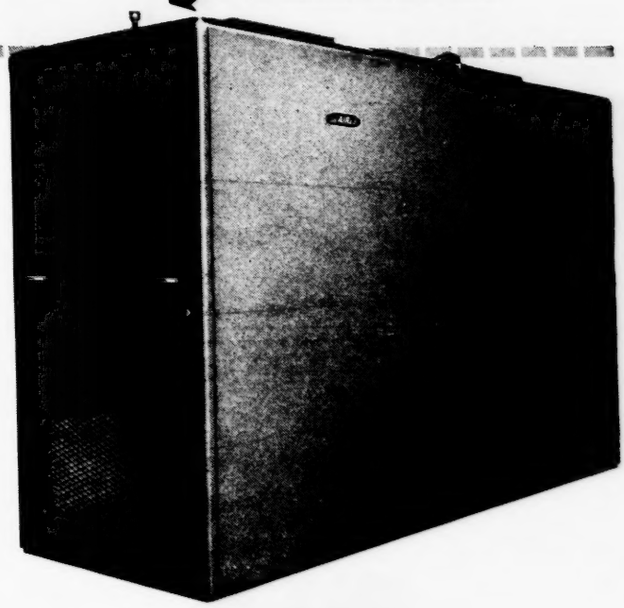
HOTEL SALES PROBLEM

Client had long wanted to air condition 115 of his higher priced rooms, but feared cost of building alterations. He was sure ductwork would lower ceilings too much and occupy rentable floor space. Also, he didn't like the idea of having those high premium rooms closed to guests all the time installation was going on. He told us not to bother him unless we could solve all his problems at once.

usAIRco SOLUTION

We told him immediately about usAIRco Modu-aire. We explained how this low cost multi-unit system is installed without space-wasting ductwork . . . how easily the necessary plumbing is installed without interfering with room rentals for more than a day or so . . . how each Modu-aire unit is equipped with coil for both cooling and heating . . . and how each room occupant may select his own temperature . . . how Refrigerated Kooler-aire Model C furnishes abundant chilled water for Modu-aire installations. We gave him his choice of the Modu-aire recessed unit or the free-standing model. In other words we solved all his air conditioning problems at once . . . with Modu-aire. He signed the order.

REFRIGERATED KOOLER-AIRE



SUPER MARKET SALES PROBLEM

Proprietor has wanted air conditioning for a long time but kept running into bothersome problems. City wouldn't give him a permit to sink a well due to water shortage. Superintendent of building claimed roof wouldn't support a tower without costly structural changes. Very limited space available to install plant. Said he was losing money not having air conditioning but didn't see how he could overcome these factors.

usAIRco SOLUTION

We told him he didn't need a well . . . didn't need a roof tower . . . didn't need any more space than he had to install a usAIRco Refrigerated Kooler-aire. We explained that Refrigerated Kooler-aire is the automatic "central plant" unit that's compacted into a single small cabinet. We showed him how its built-in evaporative condenser saves up to 95% on water consumption . . . without a roof tower. We pointed out to him that Refrigerated Kooler-aire moves in through average size doors so walls needn't be ripped out . . . how it's installed with only three simple connections. We took him to inspect other RK installations we'd made in town. We finished his RK installation last week.

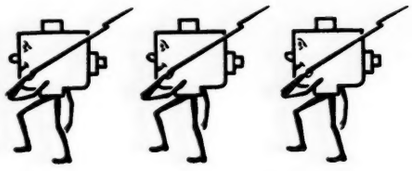
Your Sales Problem

may be different from either of these . . . but whatever it is that's keeping your prospect from buying air conditioning equipment, the chances are you'll find a usAIRco unit to turn every one of his objections into a strong, positive selling point. Next time you find yourself wrestling with a reluctant prospect, let us know. We're usually able to help you get the order.

usAIRco

UNITED STATES AIR CONDITIONING CORPORATION • Como Ave. S. E. at 33rd Minneapolis 14, Minn.

Traps..Traps..Traps..
HOW TO PICK THE RIGHT ONE



Small traps.. big traps.. square traps.. round traps.. bucket traps.. float traps.. diaphragm traps.. bellows traps..

You'll save steam and get faster heating up, higher radiator or equipment efficiency if you pick the *right* trap for each job. First step in picking the right trap is to pick a Webster Trap. Webster builds a whole family of traps in a wide range of sizes and body models. Webster "know-how" is based on 60 years of building traps.

If you are not already using the right Webster Trap all you need to do is give us a few facts about your problem – the equipment to be drained, the prevailing and maximum steam pressure, your particular operating conditions. Then we'll recommend the Webster Trap we think is the right one for you.

Remember this: the right size—not too big . . . not too small—gives best results in faster, more complete drainage, in longer service and minimum maintenance costs.

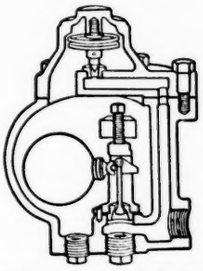
Every Webster Trap is designed to provide automatic, continuous and complete discharge of air and water of condensation . . . to hold steam in until it has given up all of its useful heat.

For information on application, prices or deliveries, call your Webster office. Or write us direct.

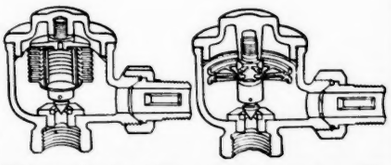
Address Dept. HV-12

WARREN WEBSTER & CO.
Camden, N. J. Representatives in Principal Cities
In Canada, Darling Brothers, Limited, Montreal

FIVE WEBSTER TRAPS IN 15 BODY MODELS

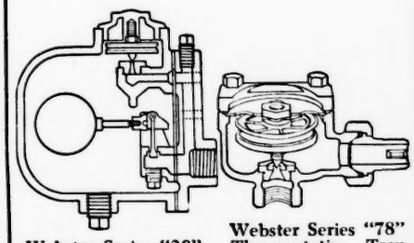


Webster Series "79" Float and Thermostatic Trap for pressures of 15 to 150 lbs.



Webster Series "5" Thermostatic Trap, bellows type, for low pressure vapor and vacuum heating. Up to 15 lbs. ½, ¾, 1" sizes.

Webster Series "7" Thermostatic Trap, diaphragm type, for low pressure vapor and vacuum heating. Up to 15 lbs. ½, ¾, 1" sizes.



Webster Series "26" Heavy Duty Drip Trap for pressures up to 15 lbs.

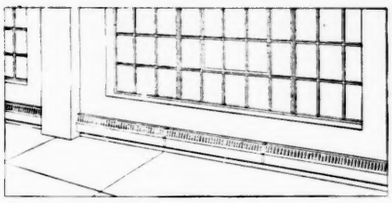
Webster Series "78" Thermostatic Trap for process, 10 to 150 lbs. ⅜, ½, ¾ and 1" sizes.

Webster HEATING

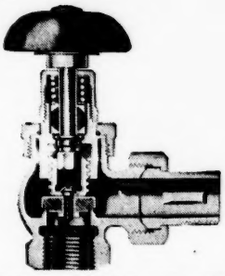
ENGINEERS . . . Check here for latest catalog data on these Webster Heating products:

☐ Bulletin B-900-4A describes Webster Electronic Moderator System. Tells how it works. Just four control elements—an Outdoor Thermostat, a Variator for manual control, a Pressure Control Cabinet, a Motorized Steam Valve.

☐ Bulletin B-200 gives full details on Webster Continuous Flow Control for forced circulation hot water heating systems. Applicable to Baseboard, Convector, Radiator or Panel Heating.



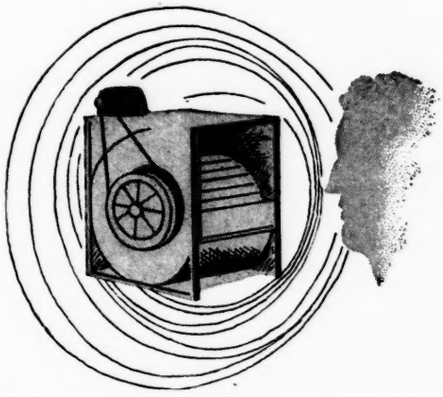
☐ Bulletin B-1551 describes the new Webster Walvector for steam or hot water heating. Non-ferrous convector with sturdy attractive enclosure. Particularly desirable for educational and institutional buildings, office buildings and other commercial structures.



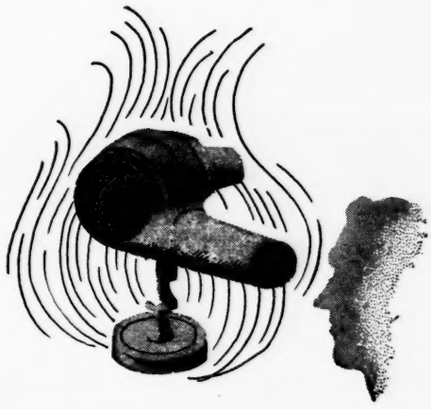
☐ Bulletin B-705 describes Webster Radiator Valves, both spring-retained and bellows packless. For low pressure vapor and vacuum heating service.

Name _____ Company _____

Address _____



President, electric blower corporation, says: "The big thing about the new fractional-hp motor standardization plan, to me is that we stand a better chance of getting 'off-the-shelf' delivery of motors when they are a big-production item, instead of a special. Also, we eliminate special jigs and fixtures, and the need for making universal mounting bases and adapter plates."



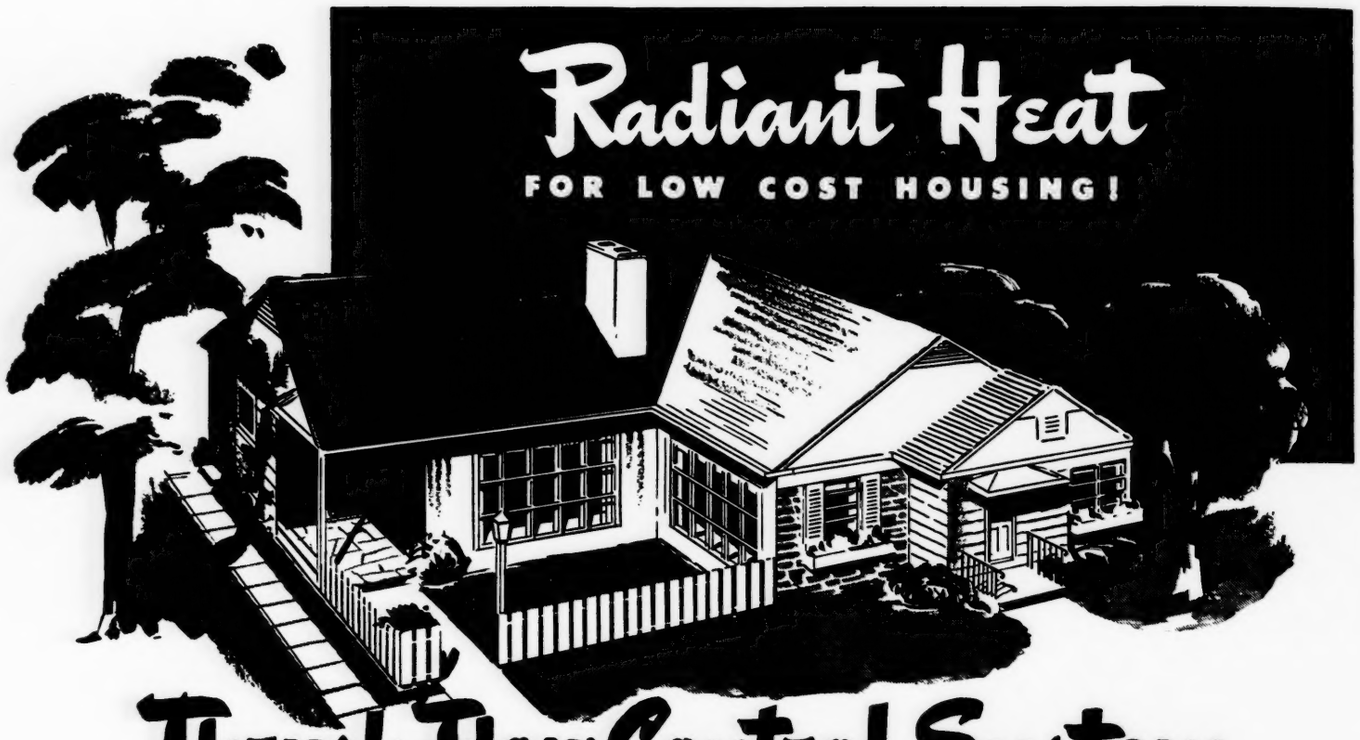
Head of oil burner firm says: "Standardization of motors and parts is most important to our company. Our burners can be made in several sizes and types without changing the motor size or application, even when making improvements and new models. Standardization means lower production and inventory costs for oil burner manufacturer and distributor or dealer."

FRACTIONAL HORSEPOWER

WANT TO SEE whether a switch to standardized General Electric fractional-hp motors will pay off for you? Our engineers will be glad to give you the unvarnished facts. Just drop us a line giving the size, type and special characteristics of the motors you are now using. For general information about fractional-hp motor standards write for Bulletin GES-3565. Apparatus Department, General Electric Company, Schenectady 5, N. Y.

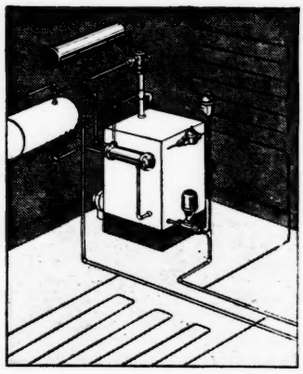
GENERAL ELECTRIC

700-99



Thrush Flow Control System
OF HOT WATER HEAT

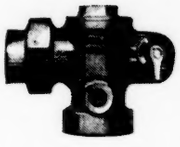
EVERYBODY wants Radiant Heating! Give them Forced Circulating Hot Water Heat, of course, because it's mild, steady, economical, and ideally suited to radiant panel, baseboard, or radiator heating. Thrush Flow Control System not only offers the best control for Radiant Heating, but costs much less to install. The controls are simple, inexpensive, highly efficient . . . and assure a continuous flow of sunny warmth throughout the entire heating season without thought on the part of the owner.



RADIANT PANEL HEAT

FORCED CIRCULATING

Thrush System provides completely automatic forced circulation for new homes or conversion jobs. The Thrush Radiant Heat Control anticipates outdoor weather changes and maintains room temperature without noticeable fluctuation.



FLOW CONTROL VALVE

THRUSH WATER CIRCULATOR

LOW OPERATING COSTS, TOO!

Not only is Thrush System lower in cost because of the simpler and more efficient controls used, but it is also more economical of fuel. There is no overheating, never any chilly feeling, no drafts . . . and no fuel is ever wasted. A plentiful supply of domestic hot water is supplied all the year around by the same heating boiler, making further reductions in both installation and operating costs. It is ideal for zoning which may also effect installation and operating economies. Ask your wholesaler about it today, or address Dept. D-12 for interesting booklet and complete information.

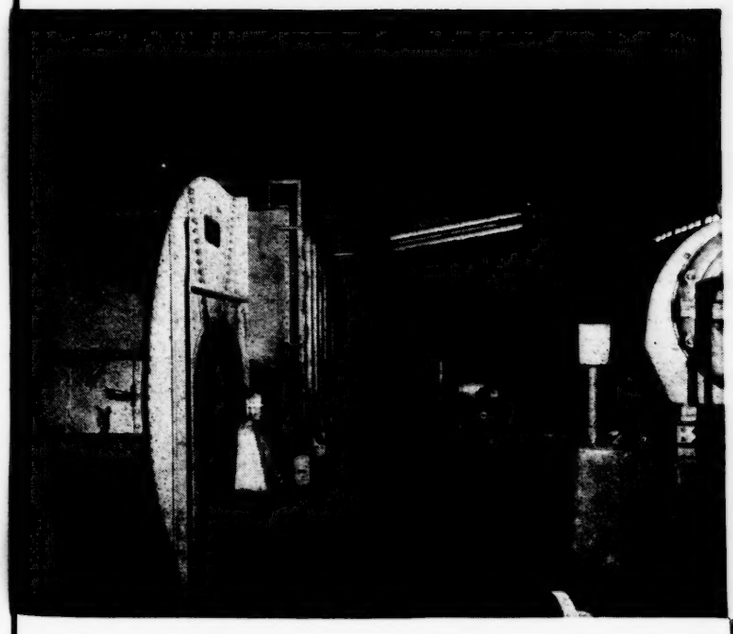
H. A. THRUSH & COMPANY

PERU, INDIANA

IF INTERESTED SEND TODAY FOR THIS FREE BOOKLET

Air of POWER

POWER: "force or energy applied or applicable to work"—*Webster*



"Buffalo" Forced and Induced Draft Fans Doing Industry's Severest Air Job Round-The-Clock at Huntley Station

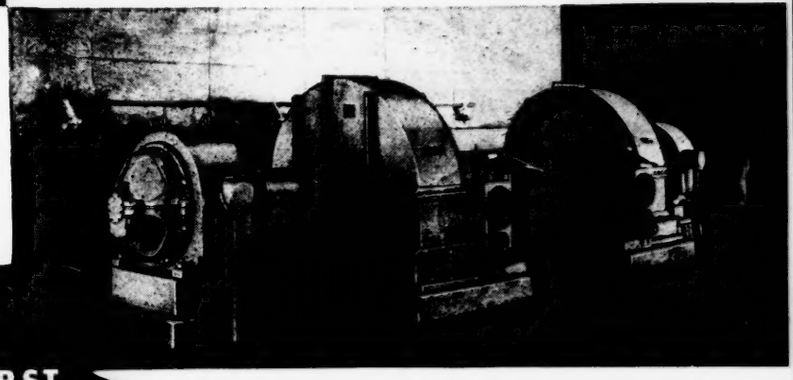
24 hours a day, these "Buffalo" Primary Air Fans blast pulverized coal and air to Huntley Station Boilers

PROMINENT POWER PLANT RELIES ON "BUFFALO" DRAFT FANS IN GRUELLING 'ROUND - THE - CLOCK SCHEDULE

● ● ● 1,775,000 pounds of super-heated steam per hour! That's the turnout of the two newest boilers of the Huntley Station's 60-cycle plant, Buffalo Niagara Electric Corp., part of the Niagara Hudson Power System. The "Buffalo" Fans shown here supply the primary and part of the secondary air to these boilers — the never-ending Air of Power on which so much depends.

Truly here, as in any boiler room, the "cheapest" draft fan is the one that runs the longest without expensive timeouts! And "Buffalo" engineers have built these fans accordingly — EXTRA HEAVY in every part where continual heat, erosion or general wear could occur. Such construction has paid for itself many times over in the thousands of "Buffalo" Draft Fans in industry.

For your Air of Power, Air of Efficiency or Air of Comfort, call on 'Buffalo" for the specialized fan or air conditioning unit to deliver it cheaper and longer. Over 70 years of "Air Know-How" back your choice.



"Buffalo" FIRST FOR FANS

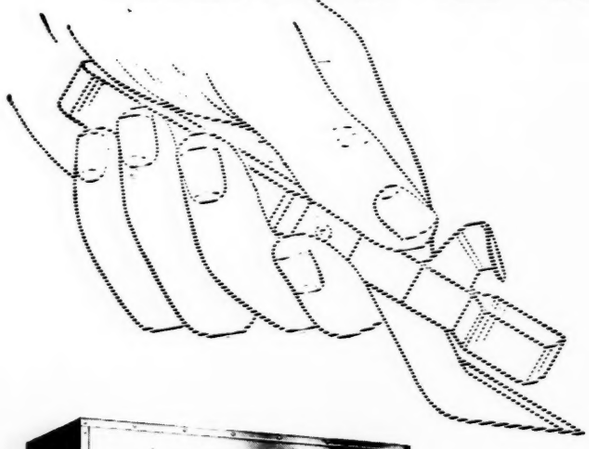
BUFFAL E COMPANY

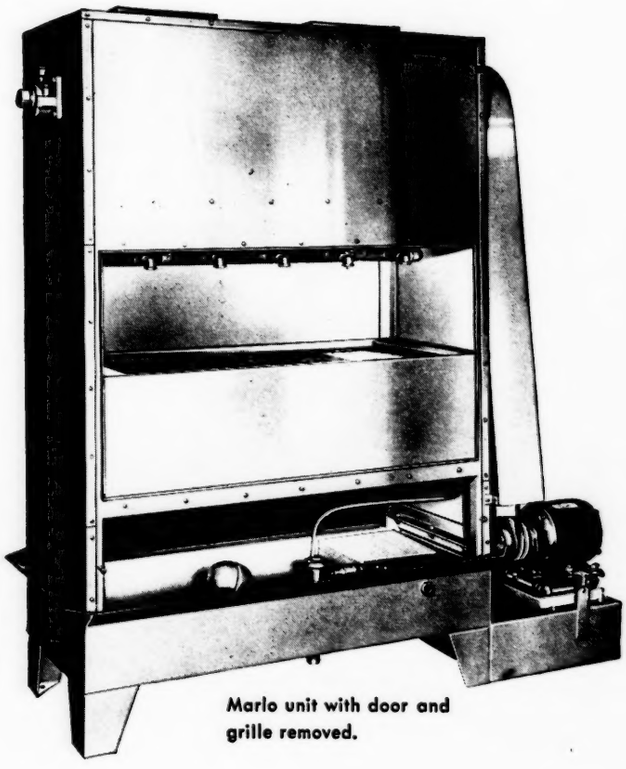
480 BROADWAY BUFFALO, NEW YORK

Ca Forge Company, Ltd., Kitchener, Ont.

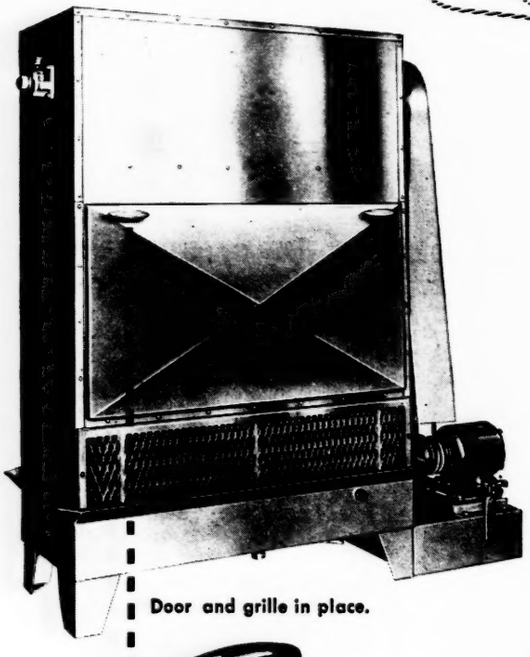
nch Offices in all Principal Cities

Accessible with handles... instead of a can opener





Marlo unit with door and grille removed.



Door and grille in place.

Corrosion-proof solid bronze door type handles used on Marlo equipment.

MARLO = HEAT TRANSFER
Since 1925

Efficiently Engineered Marlo Units

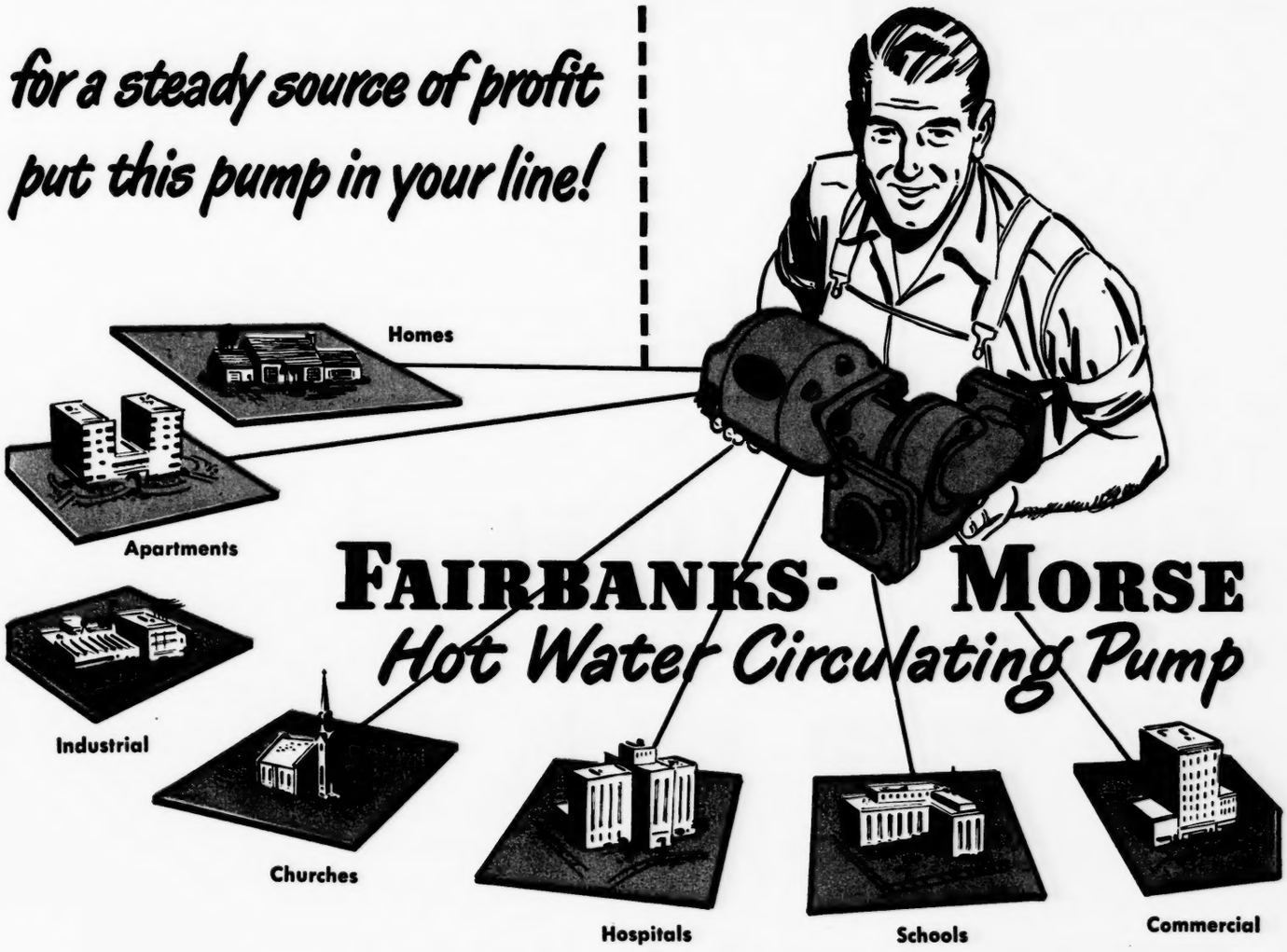
...**For Easier *Servicing***—Conveniently placed doors with bronze handles give immediate access to all working parts of Marlo Cooling Towers and Evaporative Condensers. Two screws free the grille for cleaning sump tanks.

...**For Better, Longer *Service***—Marlo Cooling Towers and Evaporative Condensers operate *economically* (with up to 95% water savings)... *quickly*—with no roar of fan blades... and their exclusive "Lektro-Tektor" sump tank unit guards against electrolytic corrosion... all design features by Marlo that mean more dependable, economical operation for your customers!

Write for infomation on the complete Marlo line.

Marlo COIL CO. • 6135 Manchester Rd. • St. Louis 10, Mo.

for a steady source of profit put this pump in your line!



FAIRBANKS-MORSE
Hot Water Circulating Pump

10 reasons why YOU will like it!

1. Steady, year-round market.
2. Easily installed—vertically, horizontally.
3. Broad appeal—many prospects.
4. Good will builder.
5. Helps find prospects for new boilers.
6. Priced attractively—profitably.
7. Reduces number of free service calls.
8. Four sizes—to meet any normal installation.
9. Replacement parts immediately available.
10. Made by Fairbanks-Morse.

10 reasons why YOUR CUSTOMERS will like it!

1. Heats *all* radiators—keeps them *hot*.
2. Maintains even temperature in *all* rooms.
3. Smooth, quiet operation.
4. Saves on fuel.
5. Rarely needs oiling.
6. Lightweight.
7. Quickly installed any time.
8. Durably made.
9. Leakproof.
10. Guaranteed by Fairbanks-Morse against defects in materials and workmanship.

MAIL COUPON FOR PRICES—FACTS!

FAIRBANKS-MORSE,

a name worth remembering

DIESEL LOCOMOTIVES • DIESEL ENGINES • PUMPS • SCALES • MOTORS
GENERATORS • STOKERS • RAILROAD MOTOR CARS and STANDPIPES
FARM EQUIPMENT • MAGNETOS

Fairbanks, Morse & Co.,
600 S. Michigan Ave., Chicago 5, Ill.

Gentlemen:
We want to know all about your circulating pump for hot water heating systems. Have your representative call.

Company name .....

Address .....

City..... Zone..... State.....

PROPERTY OWNERS AND BUILDING OPERATORS

THE NEW SHARKEY LAW

says your chimney must not smoke*

*THE SHARKEY LAW SAYS:

"It is hereby declared that pollution of the atmosphere by smoke, soot, fly ash, products of combustion, incomplete combustion or heating of fuels or refuse and certain other emissions into the atmosphere, is a menace . . . to the welfare and comfort of the people of the city and a cause of extensive damage to property."

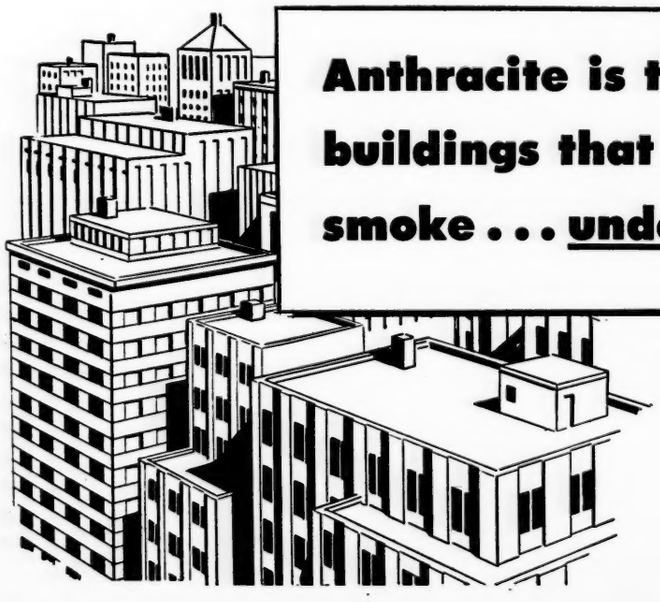
Plan now for quick compliance

Here is an easy way to make certain that you do not violate the new law and take the risk of paying fines, being imprisoned, or both.

How can you solve YOUR problem best? To help you correct your smoke problem the quickest, easiest and most economical way, you can get expert advice, at no cost, from the new Smoke Prevention Clinic. Their heating engineers will gladly inspect your installation and show you what to do.

Send for Smoke Prevention Clinic FACT SHEET

Whatever fuel you use, whatever equipment you have, the Clinic can short-cut your smoke problem. It may be that minor adjustments will solve it. Faulty drafts, inadequate combustion space, improper fuel mixture or firing methods are easily corrected. Why not send today for the useful FACT SHEET prepared by the SMOKE PREVENTION CLINIC or arrange for a personal inspection?



Anthracite is the only fuel used in large buildings that does not smoke . . . cannot smoke . . . under any firing conditions

PHONE THE SMOKE PREVENTION CLINIC

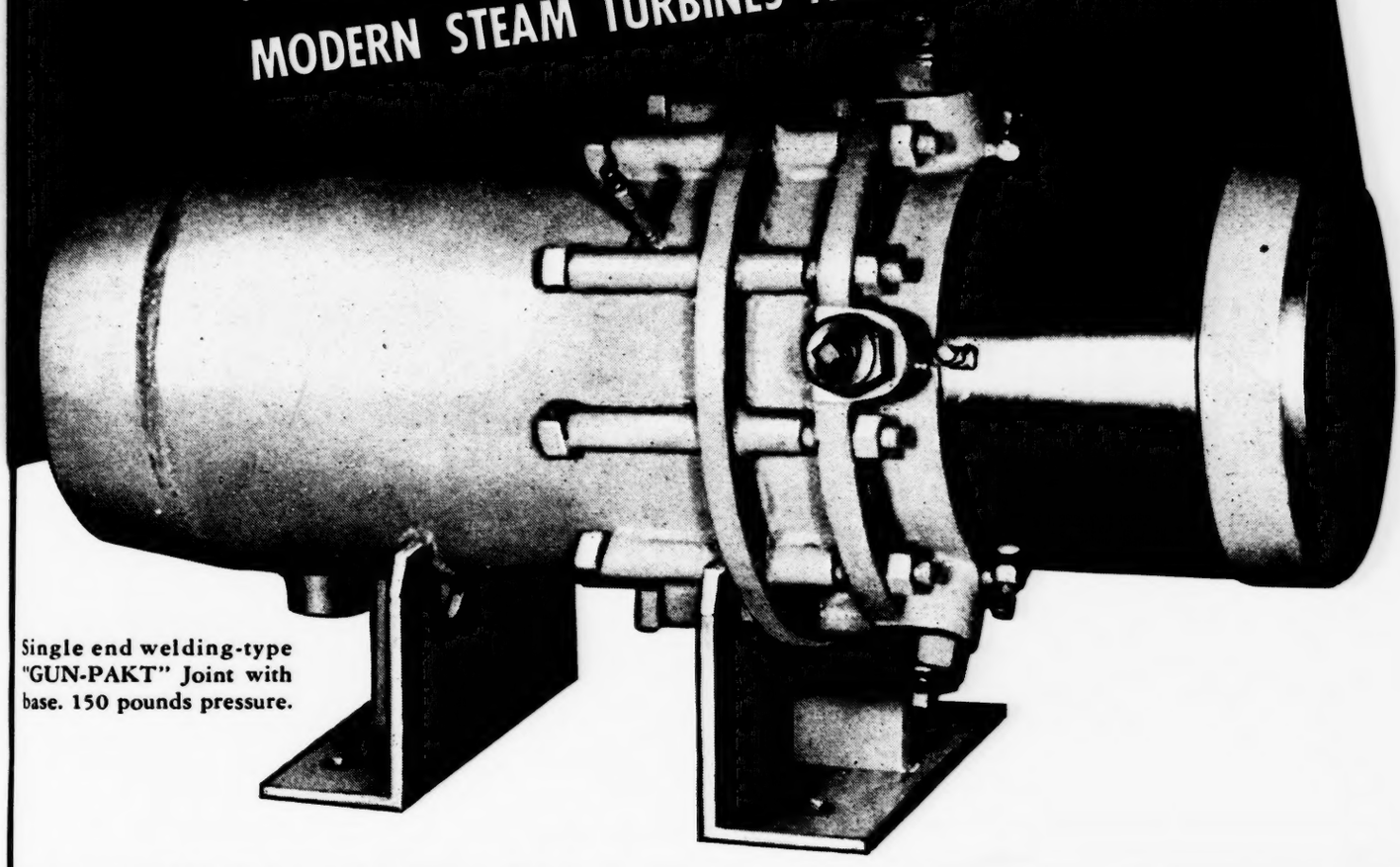
ANTHRACITE INSTITUTE

101 Park Avenue, New York 17, N. Y.

MUrray Hill 9-6890

GUN-PAKT

...AS IMPORTANT TO STEAM DISTRIBUTION AS MODERN STEAM TURBINES ARE TO POWER PLANTS



Single end welding-type "GUN-PAKT" Joint with base. 150 pounds pressure.

The "GUN-PAKT" feature has been called the greatest expansion joint improvement of modern times.

It completely eliminates the need for costly shutdowns and heating interruptions while servicing the joints. "GUN-PAKT" Expansion Joints are repacked *under full steam pressure.* Insert a packing plug, twist a wrench, and the job is done. It's as simple as that. Special Alemite fittings provide for proper lubrication.

Maintenance costs are reduced too. One user spends 65 cents per year per joint. Another sets the figure at half that! Wherever steam is distributed, the "GUN-PAKT" Expansion Joint is the one they talk about—and specify!

FOR THE FULL "GUN-PAKT" STORY, GET YARWAY'S FREE BULLETIN EJ-1912. WRITE...

YARNALL-WARING COMPANY
104 Mermaid Avenue, Philadelphia 18, Pa.

Serviced

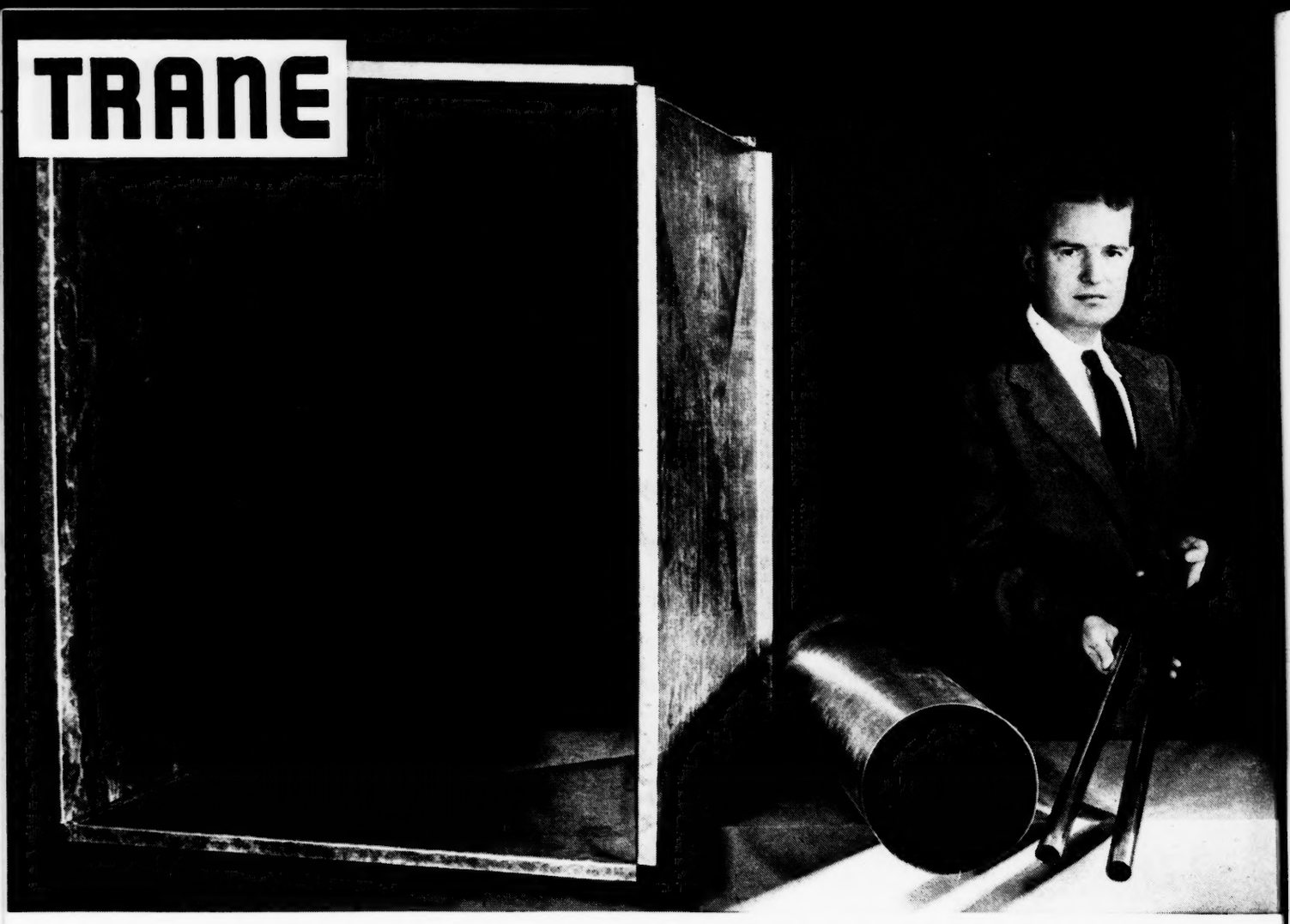
UNDER FULL STEAM PRESSURE

1. INSERT YARWAY PACKING 2. TWIST A WRENCH.

THE JOINT'S TIGHT . . . THE JOB DONE

YARWAY GUN-PAKT EXPANSION JOINT

TRANE



Going! Going! Gone! Skyscraper air conditioning has progressed from large ducts to small, until now it requires no ducts at all—only ordinary water pipe.

Skyscraper air conditioning without ducts...

Ductwork—once the "necessary evil" of skyscraper air conditioning—may still be "evil," but no longer is necessary. Revolutionary new UniTrane air conditioning eliminates entirely the need for ducts.

UniTrane is designed for the largest skycraper, and it fits small multiroom buildings, too.

It is a unit system, but there is no compressor or other complicated apparatus in the unit. Simple piping, similar to hot water heating—illustrated above—carries warm water to the unit for winter heating and chilled water for summer cooling.

UniTrane may be used for either new or remodeling work. It is so simple and so flexible that it can be installed a bit at a time if desired. It is practical and economical to make the original UniTrane installation for straight heating only, with cooling to be added later. Or units may be installed and operated in a wing, a floor, or a zone without disturbing other existing equipment.

Type MC UniTrane provides individual room control of temperature, moisture, and ventilation. All air is filtered. There is no mixture of air between rooms or corridors.

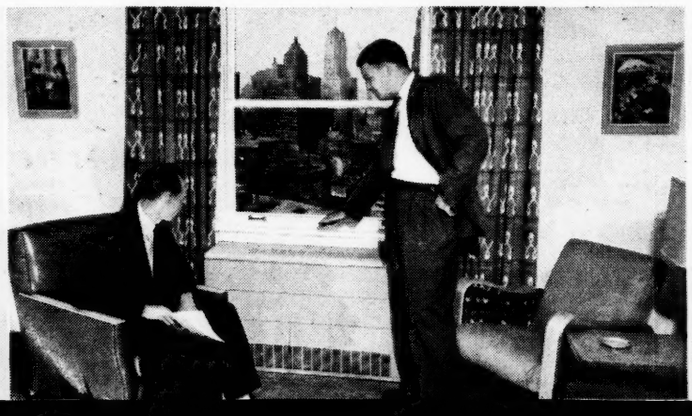
Each room has its own year-around air conditioning system, all contained in a compact package that fits under the window.

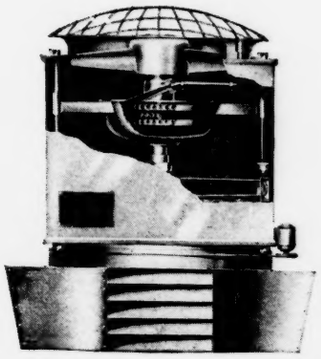
Ask the Trane sales office in your area for a copy of "Merely a Matter of Air," which covers the ABC's of skyscraper air conditioning in general, from bulky central systems to ductless UniTrane.

THE TRANE COMPANY...LA CROSSE, WIS.

Manufacturing Engineers of Heating, Ventilating and Air Conditioning Equipment—Unit Heaters, Convector-radiators, Heating and Cooling Coils, Fans, Compressors, Air Conditioners, Unit Ventilators, Special Heat Exchange Equipment, Steam and Hot Water Heating Specialties... IN CANADA, TRANE COMPANY OF CANADA, LTD., TORONTO.

UniTrane room units are beautifully styled for under window installation in offices, hotels, hospitals and other multiroom buildings. Data bulletin DS-420 is for architects and engineers..."Merely a Matter of Air" is for the non-technical reader.





The New Wing Turbine Revolving Unit Heater

This new product of L. J. Wing Mfg. Co. is the logical result of constant improvements in two specialized lines of equipment pioneered by this company.

The first Wing turbine was built as an integral part of the Wing forced draft blower 40 years ago. The first lightweight ceiling-suspended downward discharge unit heater was introduced by Wing 25 years ago.

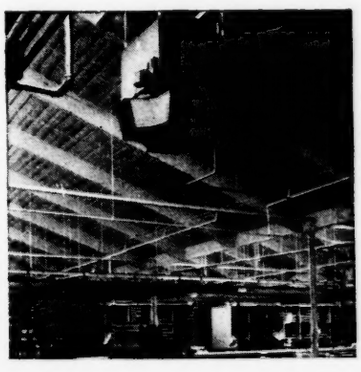
With the addition of the patented revolving discharge outlet in 1935 the next major step in the Wing program of constant improvements is the Wing Turbine Driven Revolving Unit Heater now offered.

In this, the fan is driven by the new Wing Allsteel Steam Turbine operating at any pressure, and the turbine exhaust is piped into the heater section. Thus the steam condensed in heating the air has first been used to operate the fan turbine.

Electric motor and electric power are eliminated.

Condensate from the heater is never at a temperature exceeding 170°F., even with air inlet temperatures as high as 100°F. Condensate is returned to the boiler through an open return system.

The entire unit is so designed that there is no back pressure on the turbine, assuring against leaks without the use of power-absorbing, troublesome packing. This also eliminates the need for traps and extra piping.



Only Revolving Discharges Can Thoroughly Circulate Heated Air

Industrial plant heating reaches its highest peak of perfection in the Wing Revolving Discharge Unit Heater. Unlike stationary discharge unit heaters, which project heated air in one or more fixed directions, the Wing Revolving Discharge outlets move slowly through a complete arc, flooding the entire heating area with a blanket of fresh, live warmth. The gentle air motion caused by the constantly changing directions of the heated air from the revolving discharge outlets eliminates the hot blasts and chilly areas common with stationary discharge type unit heaters—creates a refreshing, stimulating atmosphere beneficial to employee morale and productivity.

Successful applications of Wing Revolving Heaters have been made in every type of industrial plant, as well as other buildings with unique heating problems. Get complete information on this modern form of unit heating by writing today for a copy of Wing Bulletin HR-5.

L. J. Wing Mfg. Co. 158 West 14th Street, New York 11, N. Y.

Factories: Newark, N. J. and Montreal, Canada

Manufacturing Licensee for Wing Unit Heaters in Western Europe—
WANSON
9, rue Mogador, Paris 9e, France
222, rue Royale, Brussels, Belgium

WING

Wing

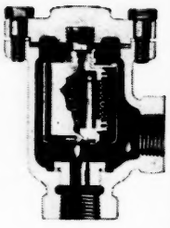
Revolving UNIT HEATERS

How to be Right the first time

WHEN SELECTING STEAM TRAPS

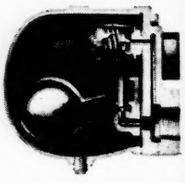
No single type of trap is suitable for all applications. But one of the four distinct Sarco types will be exactly right for any given application. Some provide quicker warm ups in the morning, some extract more of the heat, some are better for fluctuating condensate loads and others are better for out of doors. Sarco has the only plant devoted exclusively to complete lines of steam traps and temperature controls. To be sure, the first time, see Sarco first.

A THERMOSTATIC



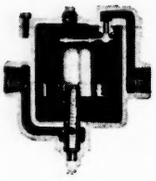
Wide open when cold for quick starts. Retains more of the heat before releasing condensate. Large valve orifice purges air quickly when starting. No seat changes when pressures change. Cannot freeze. Two types—for low pressure heating and high pressure industrial service up to 300 psi. Bulletin No. 250.

B FLOAT



Ball float allows continuous discharge without shock to temperature controls and other instruments. Automatic thermostatic by-pass takes care of air and gases without steam waste. All pressures up to 200 psi. Bulletin No. 450.

C BUCKET



Intermittent, but very rapid—can handle large volumes of condensate. Air goes out with the condensate. All parts attached to cover provide easy inspection. Straight-through connection makes installation easy. Integral strainer inside. Standard sizes to 250 psi. Forged steel types to 900 psi, and superheat. Bulletin No. 350.

D LIQUID EXPANSION

A low cost combination of trapping and approximate temperature control. Ideal for outdoor tanks and lines and other points where condensate cannot be returned. In other forms, used as combination trap and control for wash tanks, food equipment, etc. Catalog Nos. 250 and 550.

APPLICATION	1st CHOICE	2nd CHOICE
Process Tanks, small	A	C
Process Tanks, large	B	C
Dryers, Coil Type	B	A
Dryers, Fan Type	B	C
Drying Tumblers	B	A
Water Heaters	B	C
Preheaters, Fuel Oil	B	C
Rotating Cylinders	B	B
Slashers	B	B
Dry Cans	B	B
Flat Work Ironers	C	B
Presses, Laundry	C	A
Stocking Forms	C	A
Presses, Plastics	C	A
Presses, Platen	C	A
Evaporators	B	C
Steam Lines Outdoors, small	A	D

Ask for Bulletin No. 1600 "Selecting Steam Traps"

267

SARCO SAVES STEAM

SARCO COMPANY, INC.
Represented in Principal Cities
Empire State Building, New York 1, N. Y.
SARCO CANADA, LTD., TORONTO 8, ONTARIO

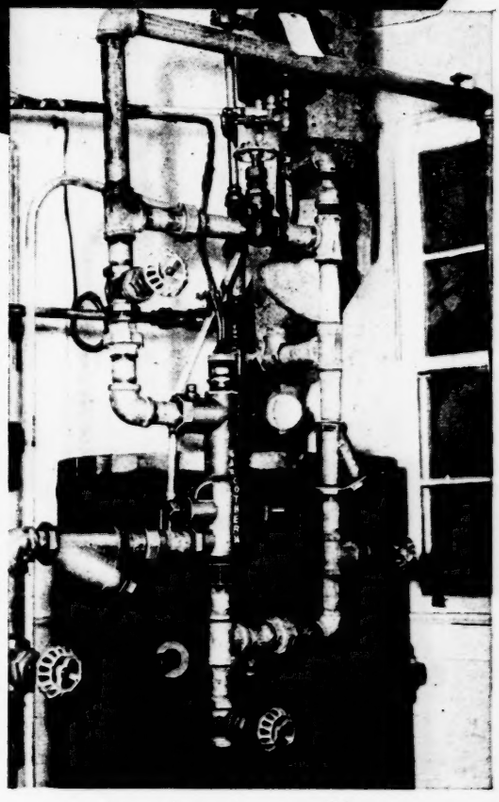
IMPROVES PRODUCT QUALITY AND OUTPUT

Wherever Comfort Counts—

SARCOTHERM

HOT WATER HEATING CONTROL

For an apartment or home, Sarcotherm is an inexpensive luxury, that is talked about among friends. In a store it provides that comfortable, expansive feeling that increases sales. And for office efficiency, there is nothing better according to users in industrial as well as commercial buildings.



Sarcotherm in a small home

NO "COLD SEVENTIES"

and no "on and off" control with Sarcotherm. It's a simple three way valve that mixes hot water from the boiler with the cooler return water.

ZONE CONTROL

Architects and Heating Engineers like Sarcotherm because it is so flexible. Zone control, split systems, set-backs and double switch lines are easily applied. Lower boiler temperatures, less fuel used and invariably a lower cost of installation, make Sarcotherm the ideal for engineers who are in daily competition.

RADIANT HEAT

Continuous circulation with modulated control is ideal. Inside control is by the exclusive Sarcotherm heat-loss thermostat. Thirty years of experience with Radiant Heating is built into every layout and every Sarcotherm.

INSIDE-OUTSIDE CONTROL

The Sarcotherm Control outside the building determines how warm the radiators should be on any particular hour of any day. Sarcotherm holds this temperature at all times, always with lower fuel costs, particularly in the Spring and Fall.

ASK FOR THE NEW CATALOG, ENGINEERING DATA AND SALES HELPS

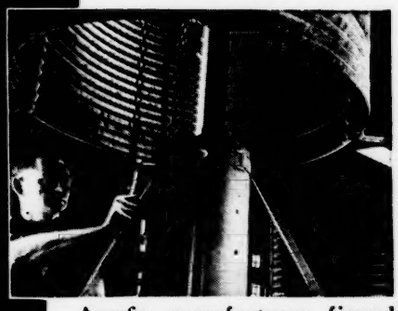
Sarcotherm

15

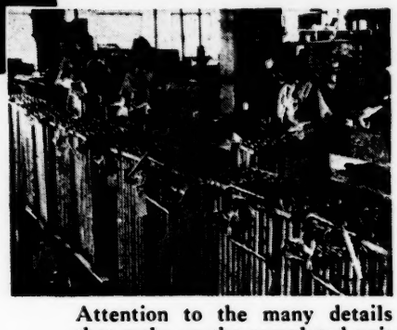
SARCOTHERM CONTROLS, INC. • Empire State Bldg. • NEW YORK 1, N. Y.

Take advantage of this

UNEQUALED EXPERIENCE
UNEQUALED PRODUCTION



Aerofin manufactures finned heat-transfer surface exclusively. The experience gained by such specialization permits the selection of just the right surface and materials for each particular job — for each application.

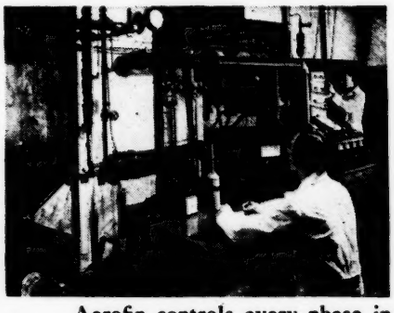


Attention to the many details that make up the completed unit typifies the Aerofin way. For instance, in this particular coil, careful brazing of the return tubes to the header plates assures leak-proof construction.

When you specify Aerofin finned heat-transfer surface, you specify high efficiency, long life and easy maintenance. As pioneer in the field, Aerofin has developed unequaled know-how and production facilities to apply to your particular heat-transfer application. Continual research accounts for the accuracy of Aerofin's published ratings. You can use them with full confidence.

Throughout the Air Conditioning Industry—

Aerofin units do the job Better, Faster, Cheaper

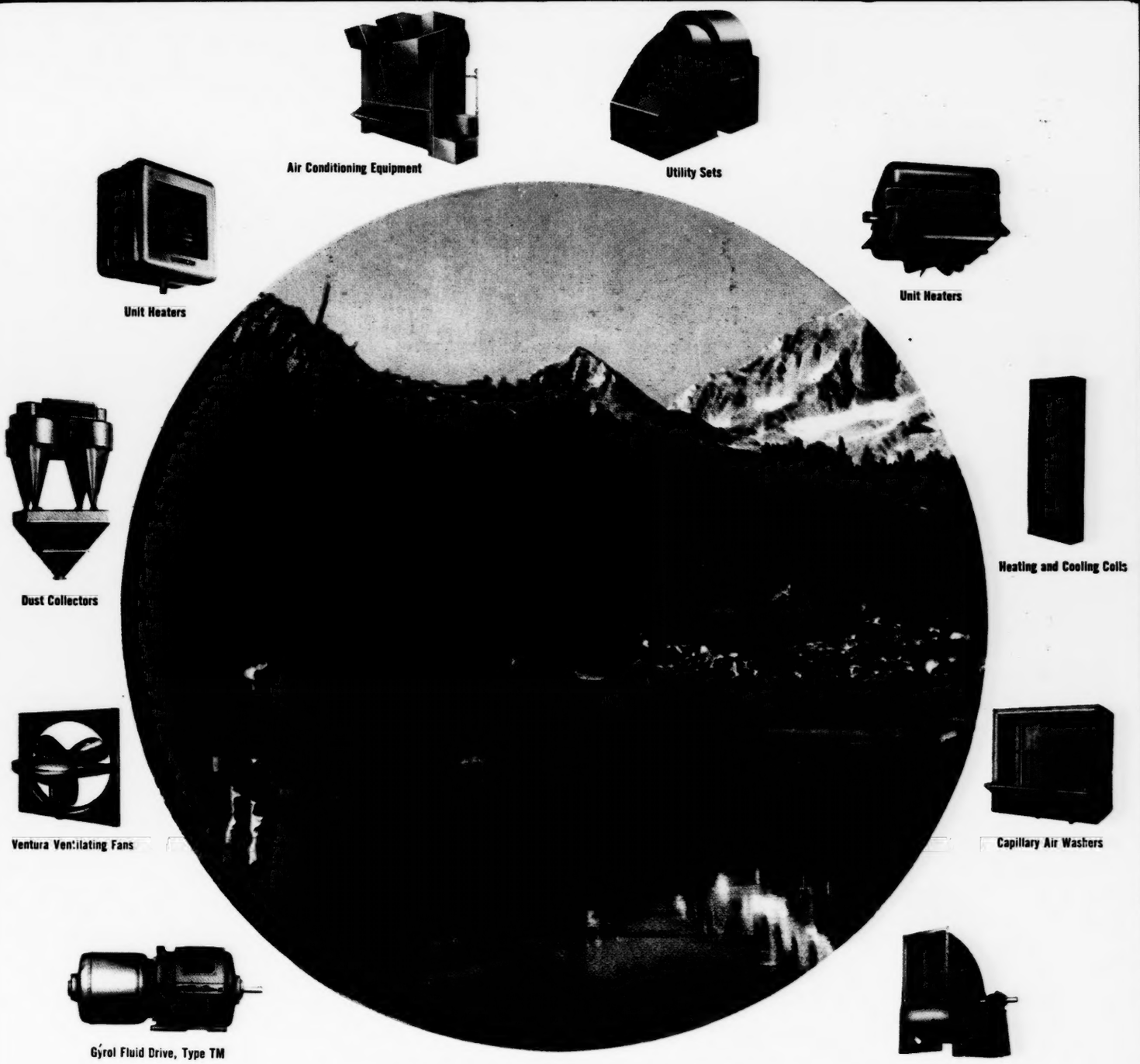


Aerofin controls every phase in the production of its finned heat-transfer coils and units. This control is maintained by rigid specifications and inspection, and all assembly is done in the Aerofin plant.

AEROFIN CORPORATION

410 South Geddes St. SYRACUSE 1, N. Y.

NEW YORK • CHICAGO • CLEVELAND • DETROIT • PHILADELPHIA • DALLAS • SAN FRANCISCO • MONTREAL



ROCK CREEK, IN THE HIGH SIERRA MOUNTAINS

Let the wonderful weather of the High Sierras remind you of the fresh, invigorating atmosphere that can be enjoyed in any business or building by installing American Blower Equipment for heating, cooling, ventilating, air conditioning or air handling.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICH. • CANADIAN SIROCCO CO., LTD., WINDSOR, ONT.

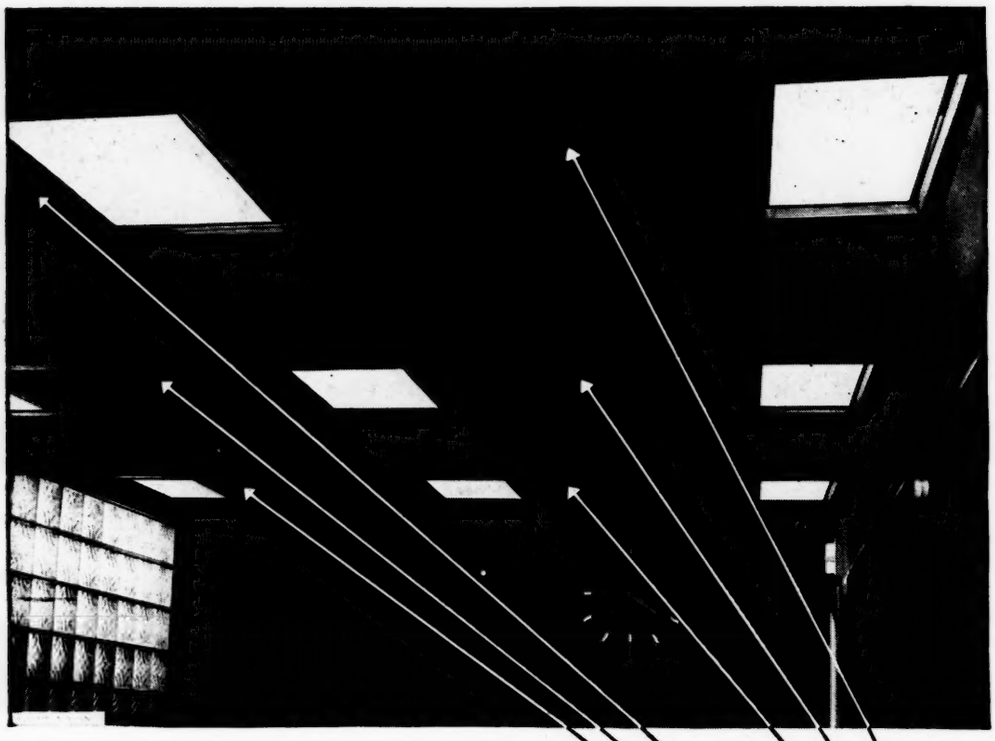
AMERICAN BLOWER

Division of AMERICAN RADIATOR & Standard Sanitary CORPORATION

Serving home and industry

AMERICAN STANDARD • AMERICAN BLOWER • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILER • ROSS HEATER • TONAWANDA IRON

For *complaint-free* low velocity air distribution

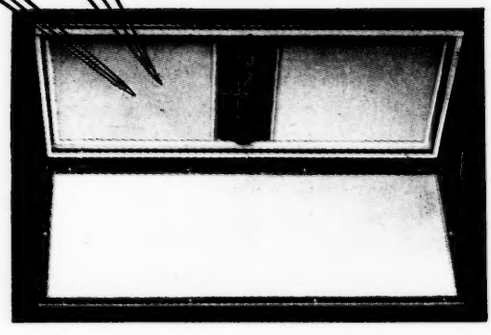


THE CARRIER CORPORATION OFFICES, New York City. Multi-Vent panels, barely discernible in beautiful, plaque-type coffered ceiling. Remarkably fine temperature regulation achieved by varying air volume in each zone with thermostat controlled modulating dampers.

Use the Best...

Use **MULTI-VENT** *Ceiling Panels*

T.M. Reg. U.S. Pat. Off.



Though the cost of supply and return air outlets is a very small percentage of the overall cost of a good air conditioning system, economizing in the selection of air distribution media is often the cause of complaints from clients on drafts, uneven temperatures, insufficient air, noise and dirty ceilings.

Multi-Vent is better able than any other diffuser to provide widespread uniform air distribution, without these common objectionable conditions because the basic draft, noise and dirt hazards, inherent in all other diffusers, are non-existent in the unique Multi-Vent principle of *distributing air entirely by displacement rather than by high velocity injection.*

In distribution by displacement there are *no* strong air streams to aim and *no* change in air flow pattern when air supply is varied. Regardless of room size, ceiling heights and relative positions of partitions, beams, etc., *all problems of outlet location and air direction adjustments for throw and drop to avoid drafts are eliminated.*

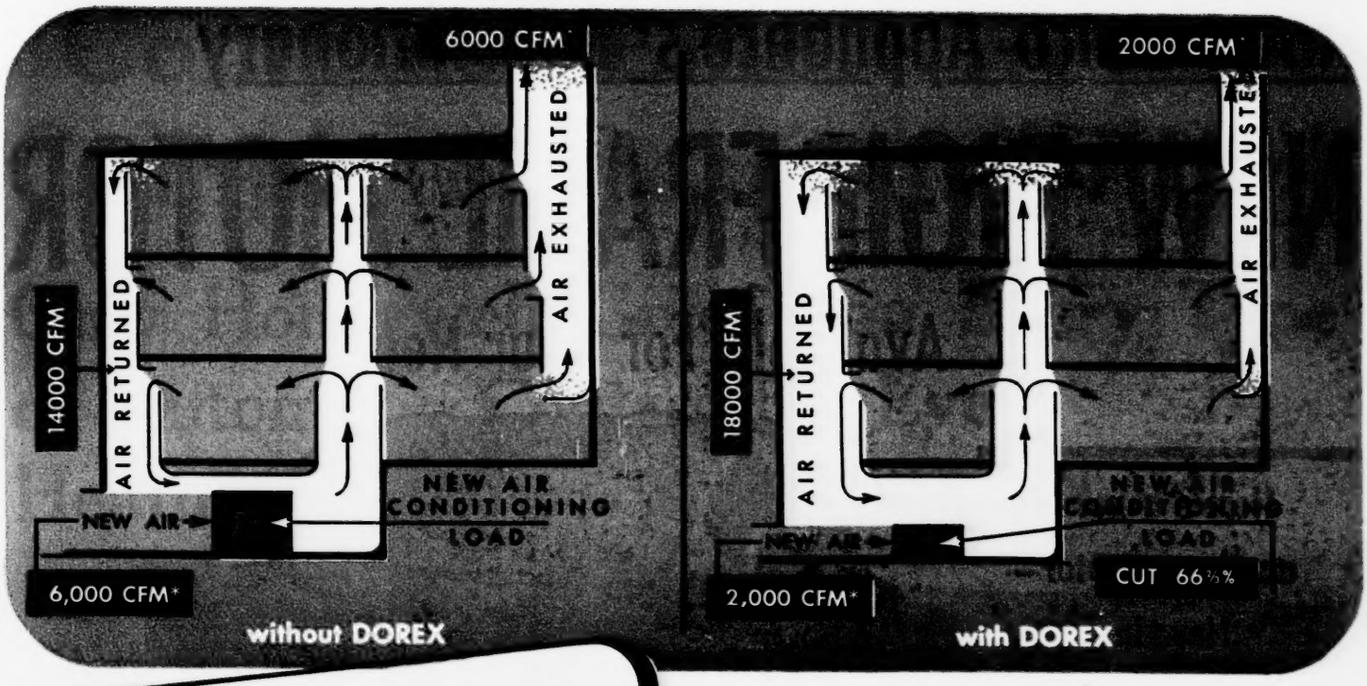
Multi-Vent, moreover, can handle greater amounts of air in proportion to room size than any other diffuser and still maintain a rate of air motion low enough to meet not only the most exacting comfort zone requirements but also to solve the high load and high ventilating problems in critical laboratory and industrial processing areas.

Multi-Vent has many other advantages such as savings in basic heating, cooling and air handling equipment in addition to the important installation, maintenance and decorating economies.

Write for detailed literature and the name of our sales engineer in your vicinity.

MULTI-VENT DIVISION • THE PYLE-NATIONAL COMPANY 1374 N. KOSTNER AVE., CHICAGO 51, ILL.

YOUR ENTIRE AIR CONDITIONING SYSTEM WILL BE JUDGED BY THE PERFORMANCE OF THE OUTLETS



How Much Money can Dorex Air Recovery save?

Briefly, here's the answer: Every 1,000 cubic feet of conditioned air that is exhausted per minute costs over $200.00 a year. If, for instance, you are exhausting 6,000 CFM, you are, in effect, throwing out $1,200.00 worth of conditioned air.

Suppose Dorex could cut that only in half. That would mean $600.00 worth of conditioned air saved. But Dorex has been able to cut air conditioning exhaust—and the unconditioned outdoor air needed to replace it—*as much as 75%* in many cases.

Dorex changes *used* indoor air back to its original outdoor freshness by removing the odorous gases that make the air stale, stuffy and unpleasant. With Dorex, you can recirculate more of the indoor air you have already heated or cooled, cut down your outside air intake and reduce your equipment and operating cost.

Net saving for each 1000 CFM recovered averages $240.00

Based on year-round conditioning system in average temperate zone.

Cost to condition 1000 CFM outdoor air per annum

Refrigeration Machinery (3 tons @ $250.00)	$750.00	
Heating Equipment (100,000 BTU @ .0025)	250.00	
15% Interest and Amortization on $1,000.00		$150.00
Power (Average 1.5 tons x 1 KW x 1200 hrs. x $0.02)		36.00
Oil (Average 0.47 gals. x 2600 x .08)		98.00
Water plus pumping cost (based on Cooling Tower)		10.00
		$294.00

Cost to recover 1000 CFM recirculated air per annum

DOREX Air Recovery Equipment installed	$160.00	
15% Interest and Amortization on $160.00		$ 24.00
Carbon Reactivation Cost (once per year)		30.00
		$ 54.00

Net annual savings per 1000 CFM $240.00

The Criminal Courts Building in New York saves money with Dorex. This famous building is just another one of the 5,000 Dorex installations furnishing more and better air conditioning at lower cost.

Engineers, contractors and dealers who have this book say it's a helpful "sales tool" in convincing those who are reluctant to invest in air conditioning in these "cost-conscious" days.

W. B. CONNOR ENGINEERING CORP.
Air Diffusion • Air Purification • Air Recovery
112 East 32nd Street CONNOR New York 16, N.Y.
IN CANADA: Douglas Engineering Co., Ltd., 100 Murray Street, Montreal 3, P.Q.

FREE BOOK
W. B. Connor Engineering Corp.
Dept. E-9, 112 East 32nd St.
New York 16, New York.

I'm interested in saving money on air conditioning.
Please send me my FREE copy of "Green Air."

Name_____
Position_____
Company_____
Street_____
City_____ Zone____ State_____

Now! Delco Appliance's Revolutionary

NEW RIGIDFRAME MOTOR

Available For Your Needs

Here's a new appliance motor— New in mechanical features— New in electrical performance

Rigidframe

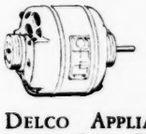
In the new DELCO APPLIANCE RIGIDFRAME motor four welded struts lock the laminations in place and provide a rigid frame upon which the motor is assembled. The recent development of new welding techniques by Delco Appliance engineers makes possible this revolutionary type of motor construction which has superior mechanical features and electrical performance.

RIGIDFRAME CONSTRUCTION insures against misalignment frequently caused by rough handling in manufacture and shipping. The rigidity of the welded struts and motor end heads assures concentricity between stationary and moving parts—maintains positive bearing alignment, assuring freedom from binding or freezing. Magnetic noise is greatly reduced, too—with resultant quietness of operation.

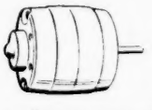
RIGIDFRAME CONSTRUCTION allows maximum utilization of magnetic material—thus reduces electrical losses and improves electrical performance. This effective use of magnetic material results in a high pullout torque, which insures against burned out windings under heavier work loads.

In addition to these outstanding features the new DELCO APPLIANCE RIGIDFRAME motor has a one-piece, die-cast rotor and fan for added performance—a heavy duty starting switch which gives smooth, trouble-free starting under maximum loads—and nylon insulated windings covered with a thermo-setting insulation varnish, for freedom from electrical breakdown.

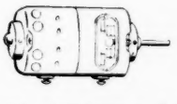
The new RIGIDFRAME motor is another example of the engineering and research that has made Delco Appliance a leader in the production of small motors. Whether you need a Split-Phase, a Series-Universal, or an automotive Heater and Defroster motor—you can depend on Delco Appliance design and quality. Our engineers will be glad to work with you in designing the motor to fit your exact needs.



NEW DELCO APPLIANCE RIGIDFRAME SPLIT-PHASE MOTORS for washing machines, ironers, blowers, control devices, office equipment, and other electrical appliances.



DELCO APPLIANCE AUTOMOTIVE HEATER AND DEFROSTER MOTORS. Also for seeders, small blowers, cooling and ventilating fans, and other appliances.



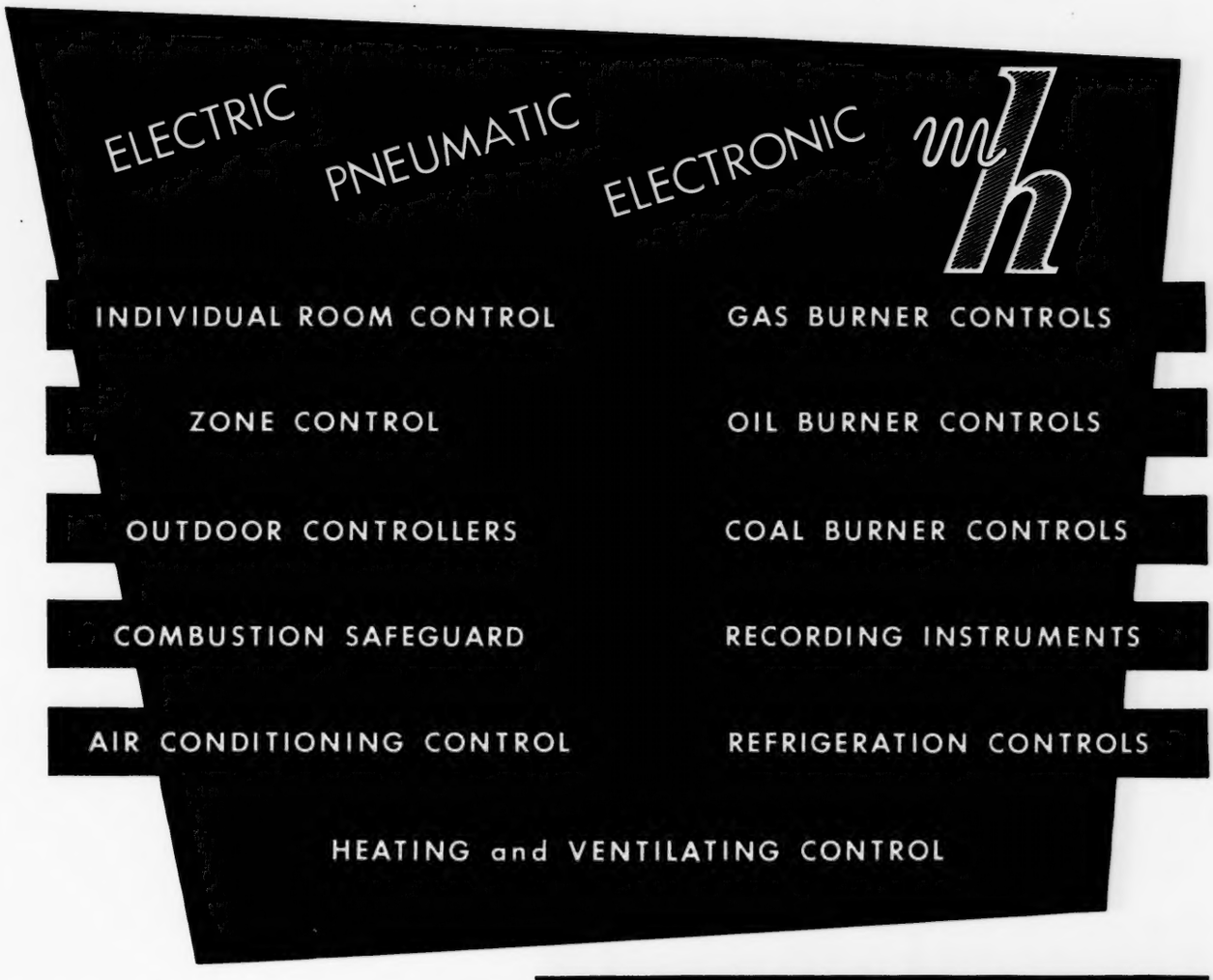
DELCO APPLIANCE SERIES-UNIVERSAL MOTORS for sewing machines, office machines, small blowers, motion picture projectors, farm machinery and other uses.

DELCO APPLIANCE DIVISION, General Motors Corp., Rochester, N. Y.

Also manufacturers of automatic Delco-Heat and Delco Water Systems for farms and homes.

Complete Line..... Complete Responsibility!

Only Honeywell Gives You Every Type of Automatic Control for Every Heating and Air Conditioning Need



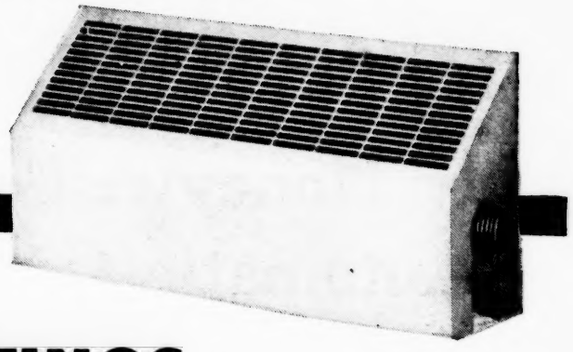
ONLY Honeywell offers a line of controls that's *complete*, for every type of installation in any building, new or old, large or small. So standardize on Honeywell. Gain the two-fold assurance only Honeywell can offer —undivided responsibility for all controls on the job, plus recommendations free from all prejudice. Put your confidence where you know it can be supported. Minneapolis-Honeywell, Minneapolis 8, Minnesota. In Canada: Leaside, Toronto 17, Ontario.

MINNEAPOLIS
Honeywell
CONTROL SYSTEMS

77 BRANCHES FROM COAST TO COAST WITH SUBSIDIARY COMPANIES IN: TORONTO • LONDON • STOCKHOLM • AMSTERDAM • BRUSSELS • ZURICH • MEXICO CITY

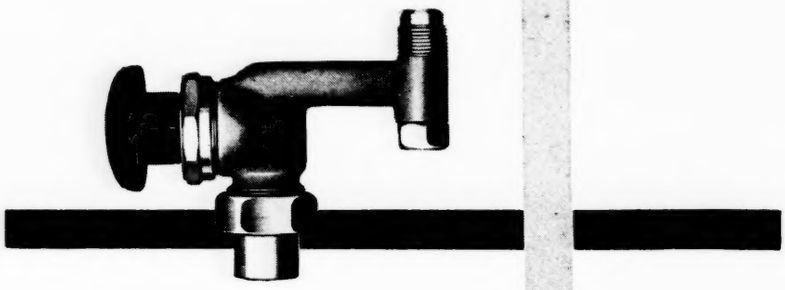
From

FIN-VECTOR RADIATION



To

REGULATING FITTINGS



DUNHAM HEATING PRODUCTS

prove their worth on every job!

Increase customer satisfaction *and* your profit

Dunham Fin-Vector Radiation is a case in point. These long, narrow, finned pipe heating elements are ideal for many installations where standard radiators are not suitable. They are light in weight but of unusual strength and heating capacity and are available with attractive covers.

Unique Dunham design enables the fins to be interlocked when pressed on to the pipe. This tight mechanical joint provides a permanent and greater contact area between fins and pipe . . . eliminates use of solder bond without sacrifice of heat transfer. Single pipe feature permits high, safe working pressures . . . absorption of sudden shock without injury.

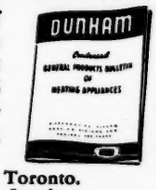
Products Like These Help Dunham Vari-Vac* Heating Cut Fuel Costs Up to 40%

It's quality products like these that enable Dunham Vari-Vac Differential Heating to effect sensational fuel savings in Spokane's Davenport Hotel, the Rochester General Hospital and other well-known buildings all over the country.

So, whether your customer needs a simple regulating fitting, finned pipe radiation . . . or a complete system to heat his entire building . . . it will pay you to investigate the broad line of Dunham Heating Products.

SEND FOR THIS CONDENSED CATALOG

Write today for your free copy of Bulletin 634-B, containing complete information on all Dunham Heating Specialties, Unit Heaters, Pumps, Cabinet and Baseboard Radiation.



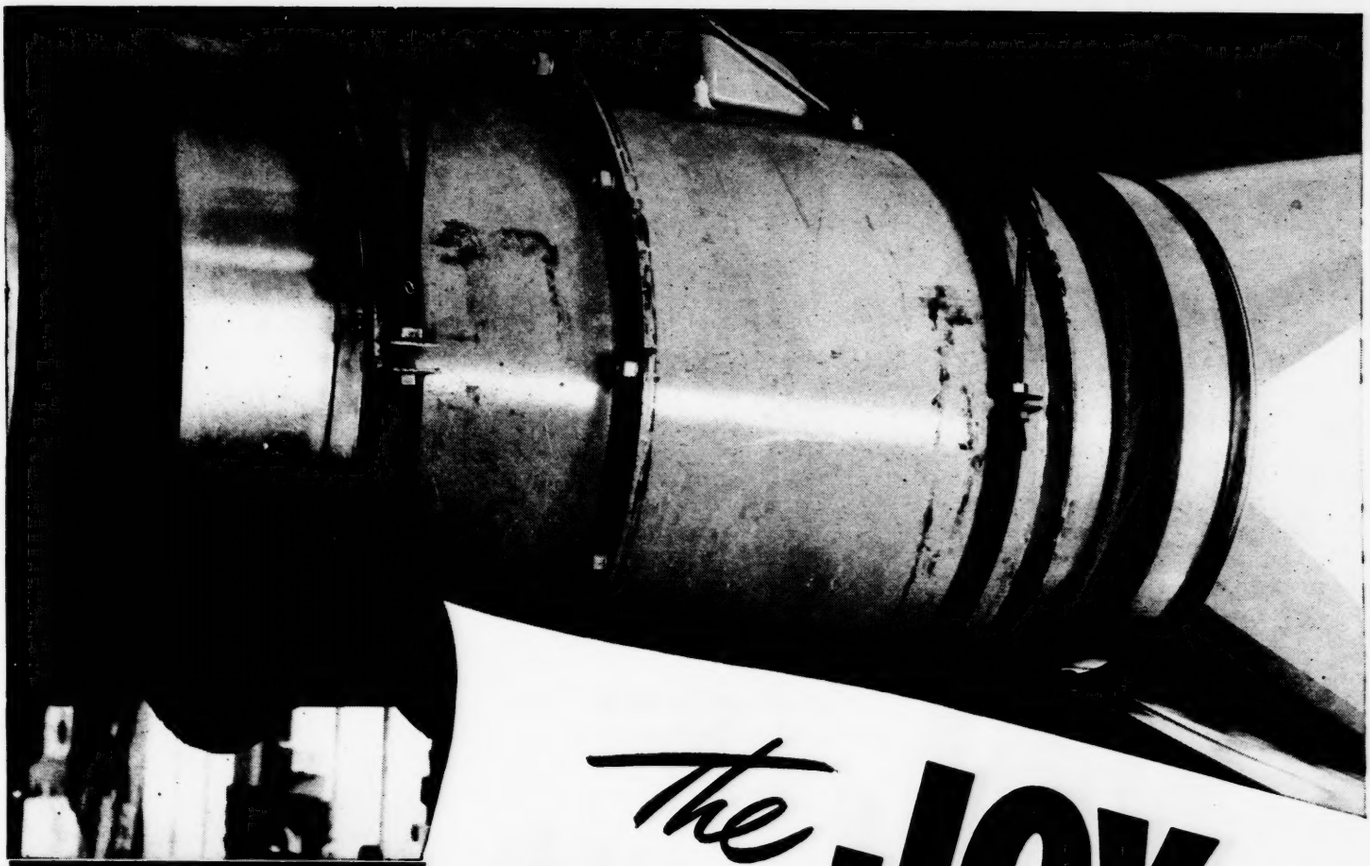
C. A. Dunham Co., 400 W. Madison St.
Chicago 6, Ill.

In Canada: C. A. Dunham Co. Ltd., Toronto.
In England: C. A. Dunham Co. Ltd., London.

**Variable vacuum*

SALES ENGINEERS **DUNHAM** **AND JOBBERS IN ALL PRINCIPAL CITIES**

HEATING MEANS BETTER HEATING



the JOY AXIVANE® FAN

Mounts Right in the Air Duct—

Saves space, installation costs, gives you quieter, more efficient ventilation!

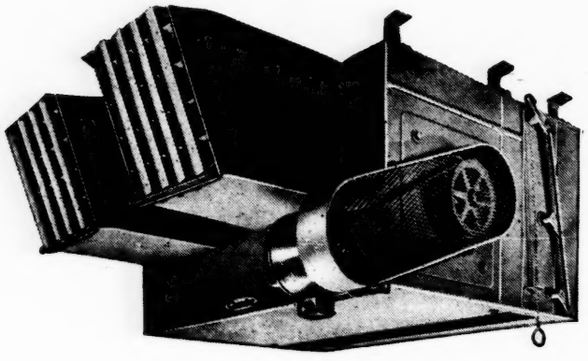
Consult a Joy Engineer

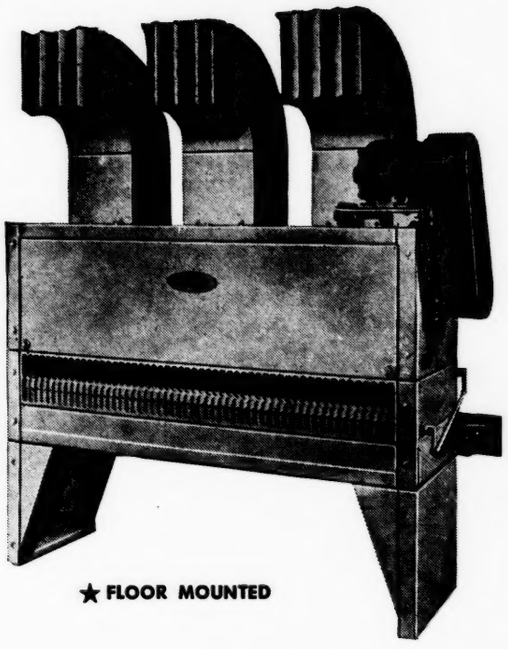
JOY MANUFACTURING COMPANY

GENERAL OFFICES: HENRY W. OLIVER BUILDING · PITTSBURGH 22, PA.

IN CANADA: JOY MANUFACTURING COMPANY (CANADA) LIMITED, GALT, ONTARIO

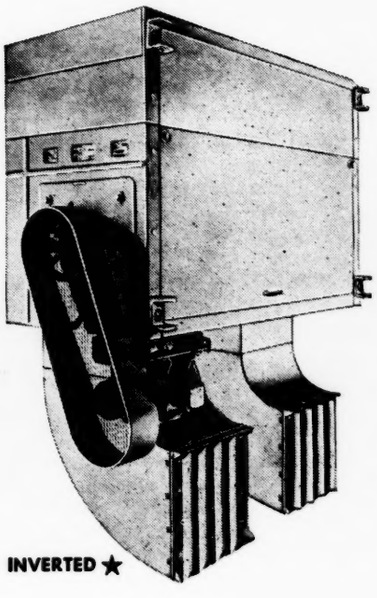
★ HORIZONTAL





★ FLOOR MOUNTED

These big space heaters are big fuel savers



INVERTED ★

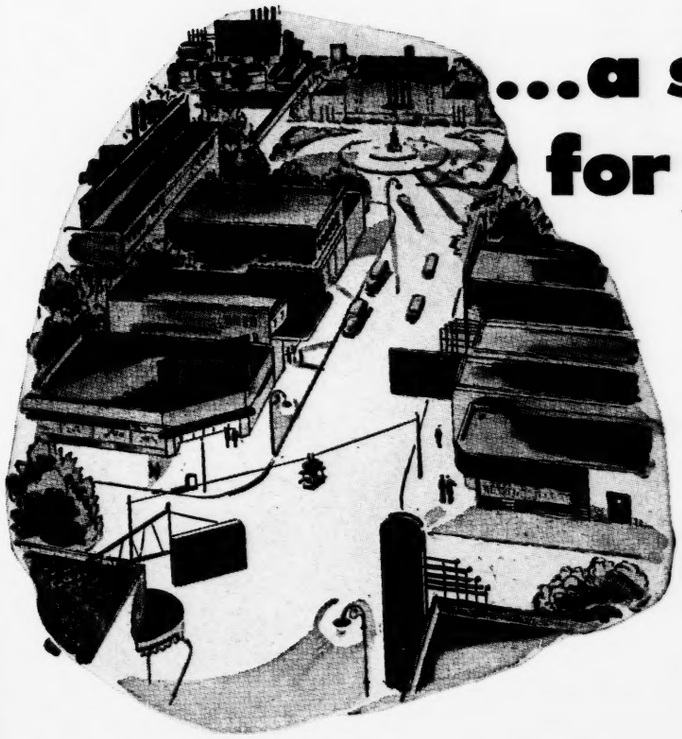
For providing low-cost heat to every corner of large, enclosed areas, Carrier Heat Diffusers have no superior. They supply it evenly under all conditions at full or partial loads, and their advance design keeps fuel costs at a minimum. That's why more and more of them are being installed in factories, warehouses, garages and other industrial-type buildings throughout the country.

These standard units control heat flow either by Carrier non-freeze steam-distributing tube coils and modulating valves — or by Carrier Thermadjust by-pass with modulating electric control at full steam pressure. Adaptable to drying and ventilating as well as heating, they come in a wide range of capacities . . . and *do not need duct work*. In fact, they are shipped as a complete assembly, ready to operate. Louvers are adjustable, and sectional design facilitates floor mounting or suspension with vertical or horizontal discharge.

Three Carrier Heat Diffusers are shown here. They represent the last word in Carrier design and engineering skill, developed through years of experience and research in air conditioning, refrigeration and industrial heating. Like all products in the Carrier line, they are built to give long years of economical service. Carrier Corporation, Syracuse, N. Y.

Carrier AIR CONDITIONING • REFRIGERATION • INDUSTRIAL HEATING

BRUNNER SINCE 1906 **REFRIGERATION** helps you serve better



...a size and type for every purpose

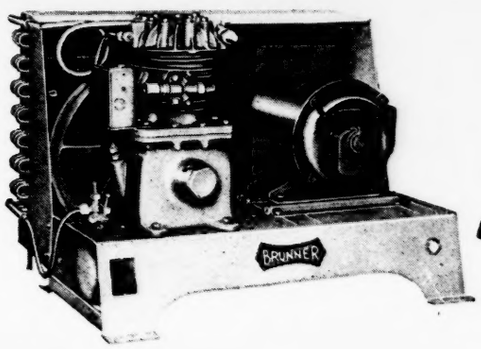
STANDARDIZE on Brunner Condensing Units. Strengthen your sales and service advantages by having available *customer accepted* units in sizes and types fitted to every refrigeration job.

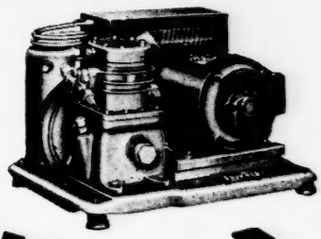
Equipment manufacturers, air conditioning engineers and contractors, general refrigeration engineers and service companies can profit more when backed by a source of supply with ample, self-controlled production facilities.

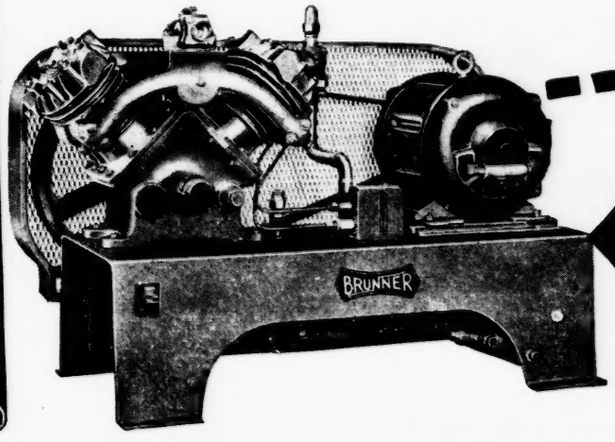
Brunner Condensing Units are continuously advertised to the "user" trades and industries. They are known by their service records...preferred for their operating efficiency, economy and long life.

BRUNNER MANUFACTURING CO.
Utica 1, New York, U. S. A.

● 22 Brunner branch office representatives who really know refrigeration are available whenever you say the word. We sincerely believe a meeting with one of these men would prove useful and well worth your time.







REFRIGERATION CONDENSING UNITS
...a size and type for every purpose

BRUNNER
SINCE 1906

AIR AND WATER COOLED MODELS
¼ HP. TO 30 HP.

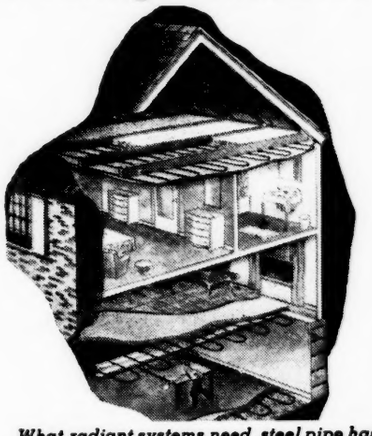
AMERICA Takes to Radiant Heating

Steel Pipe is First Choice for this modern heating method . . .

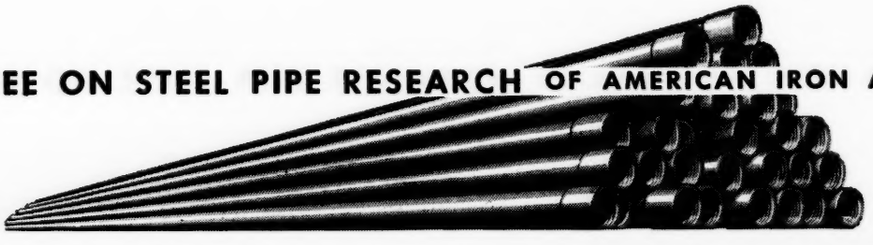
Home is where the *heat* is . . . for since time immemorial the center of family life has been around the source of warmth!

Now, of course, modern engineering has extended the comforts of heat to every room in the house, and has expanded the choice of effective systems to include the growing *radiant heating* method. American home owners have taken to Radiant Heating with enthusiasm, not only because of its popular advantages, but because time-tested materials in which they have *confidence* are "part and parcel" of the system.

Durable, reliable, economical *steel pipe* . . . the same pipe that has been keeping America warm for decades . . . is the *heart* of Radiant Heating. Proved through more than 60 years of service in conventional hot water and steam systems, *steel pipe is,* naturally, *first choice* for *Radiant Heating,* too.



What radiant systems need, steel pipe has! Easy to form and weld. Expansion co-efficient same as concrete and plaster. Outlasts useful life of building. Economical.



COMMITTEE ON STEEL PIPE RESEARCH OF AMERICAN IRON AND STEEL INSTITUTE

350 Fifth Avenue
New York 1, N. Y.

SEARS ROEBUCK
JEFFERSON ST. STORE

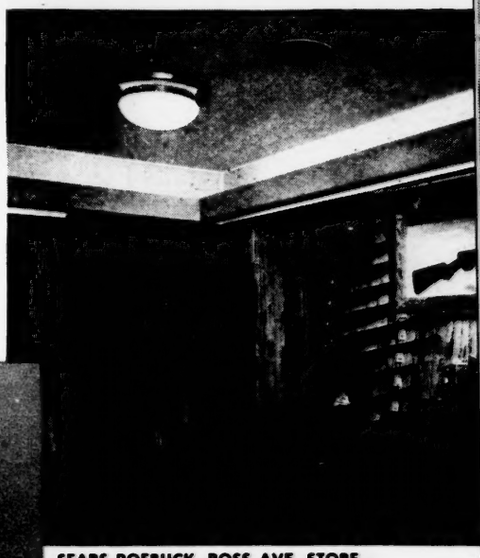
MERCANTILE BANK BUILDING

Aerofuse IN DALLAS

DALLAS MORNING NEWS BUILDING

In this great Texas city — and in other major centers throughout the Lone Star state — air conditioning is an important part of new commercial, institutional and industrial construction. *At the vital point of air delivery* in many of these important buildings, Aerofuse Diffusers are specified for installation. From experience, the outstanding engineers, architects and contractors — responsible for the performance and appearance of these jobs — know that Aerofuse Diffusers are engineered to meet the most rigid requirements of air distribution . . . are styled to harmonize with the most modern interior design.

Aerofuse Diffusers are available in a wide range of types and sizes . . . for the details, selection information, complete engineering data . . . write for a copy of Catalog 102.



SEARS ROEBUCK, ROSS AVE. STORE

TYPE EAC
WITH No. 4 CONTROL UNIT

Typical of the advanced engineering that is an important part of the Aerofuse line, TYPE EAC is equipped with a manually-operated auxiliary effective area control ring. Provides a simple method of varying performance by adjustment of throw . . . on the job. No. 4 Control Unit assures minute regulation of volume.

OTHER TYPICAL AEROFUSE INSTALLATIONS IN DALLAS

WRITE FOR CATALOG 102

TUTTLE & BAILEY inc

NEW BRITAIN, CONNECTICUT

OUR BUSINESS IS IMPROVING YOUR BUSINESS

YORK'S EXCLUSIVE CERTIFIED MAINTENANCE PROGRAM

takes Guesswork out of Expense of Operating Air Conditioning Systems

OWNER SATISFACTION in the system *you* recommend or install is important. To maintain full efficiency at all times and reduce overall operating costs, York offers owners of York air conditioning systems exclusive Certified Maintenance Contracts. These contracts assure satisfactory performance and result in better care of equipment.

YORK'S CERTIFIED MAINTENANCE PROGRAM is time-tested. Today thousands of these contracts are in effect—a remarkable tribute to a priceless service. Don't forget that in addition to superb quality of product, York offers this service to insure your client's satisfaction throughout the years.

York Recommends Your Services

That's basic philosophy with York. Wherever practical, York believes in channeling air conditioning work through *you* as representative of the ultimate user. To back up your recommendations and services, York provides this balanced program:

- **a complete line of equipment**
- **competitive prices**
- **accurate, dependable product ratings**
- **technical assistance based on "case histories"**
- **cooperation with architects, engineers, and contractors**
- **practical help from York-Trained Engineers**
- **a national organization**
- **continuous product research and development**
- **certified maintenance**

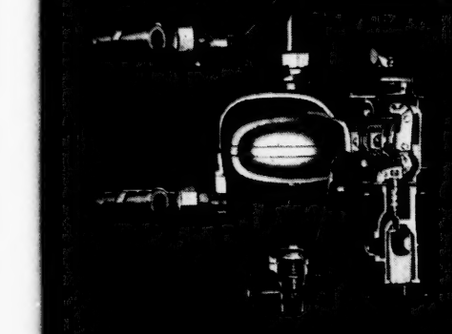
If you are "planning" any job requiring air conditioning or refrigeration, call your York District Office. Experienced Sales Engineers are available to give you *complete and personal* assistance at all times. York Corporation, York, Pennsylvania.

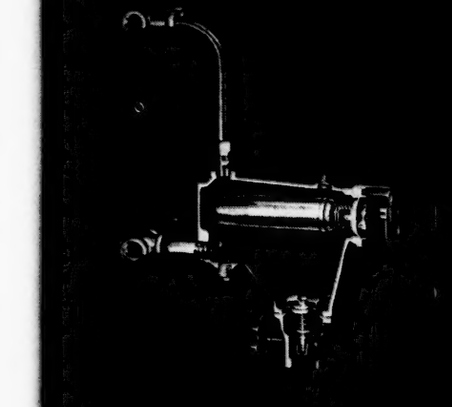
York refrigeration air-conditioning

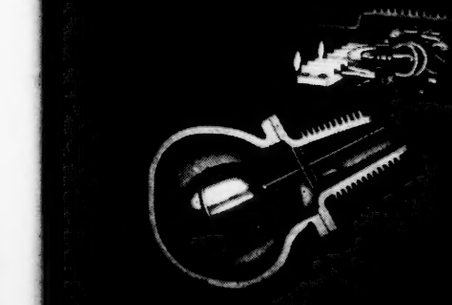
PIONEERS IN INVENTION AND DEVELOPMENT SINCE 1874

Refrigeration and Air Conditioning

HEADQUARTERS FOR MECHANICAL COOLING SINCE 1885







Wipe off that worried look, Sam, it's Christmas!

The Sam-you-better-scram idea has had a big year—not a bit bigger, we feel, than it deserves—but a big year just the same.

So while the vital and basic idea of boiler protection merits success, we are no less aware of the great job our many friends in the heating industry have done in selling boiler protection throughout the tumultuous year of 1949.

Yes, considering the business trend, you did the best job for us in selling McDonnell products that you have ever done . . . and the fact that you were able to reverse the trend this year, shows that the Sam-you-better-scram idea is deserving of all the effort you have given it—even greater effort in the new year just around the corner.

Meantime our thoughts, touched off by the Christmas decorations that are popping up around town, race over the housetops and lakes and mountains and states like Saint Nick and his sleigh to extend a hearty thanks and a Merry Christmas to all.

Let's hope even Sam can wipe off that worried look for a handshake all around!

McDONNELL & MILLER, INC. 1313 Wrigley Bldg., Chicago 11, Ill.

Doing One Thing Well

McDONNELL

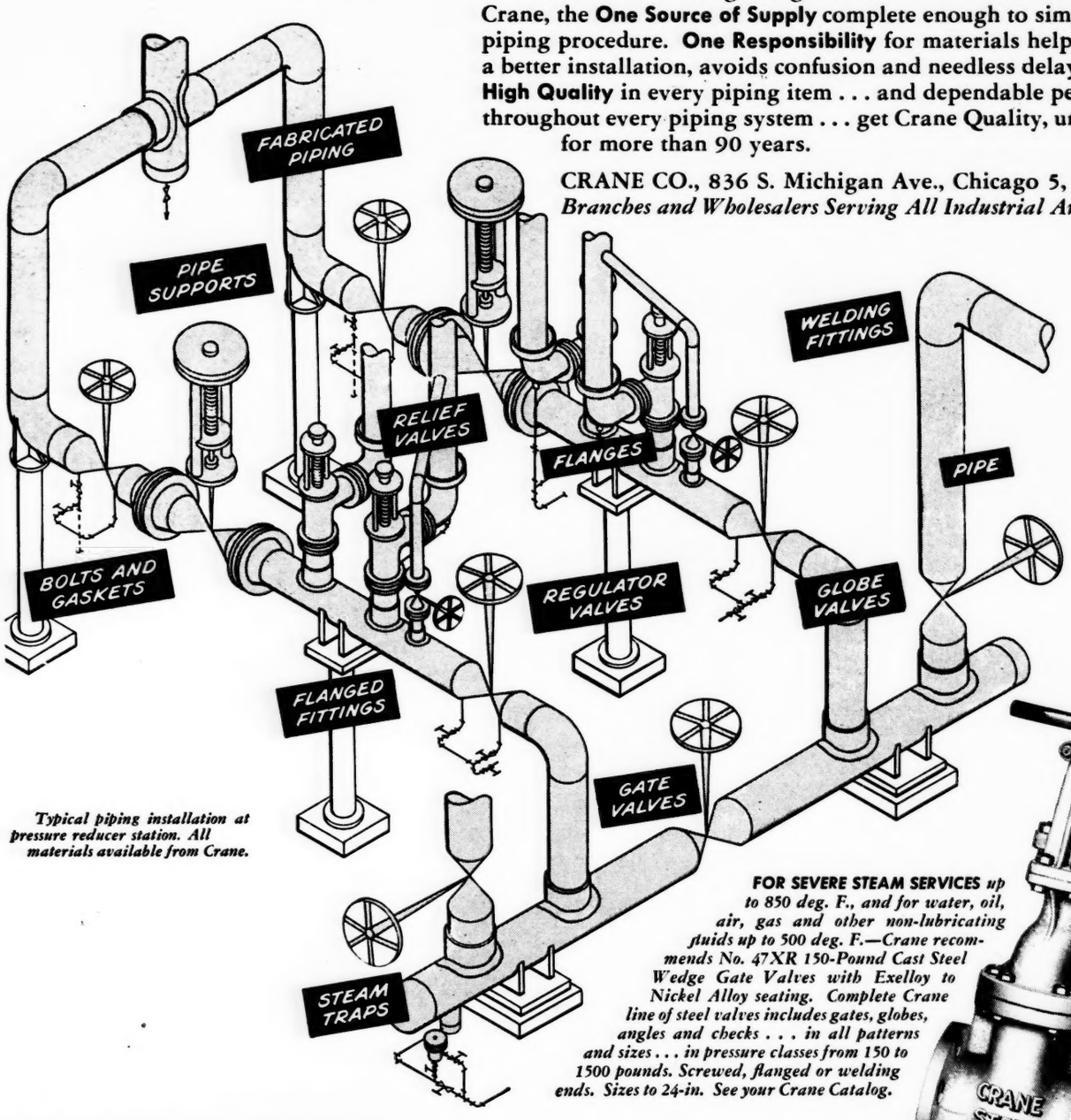
For every pressure and temperature condition ...CRANE piping meets the need

ONE SOURCE OF SUPPLY
RESPONSIBILITY
STANDARD OF QUALITY

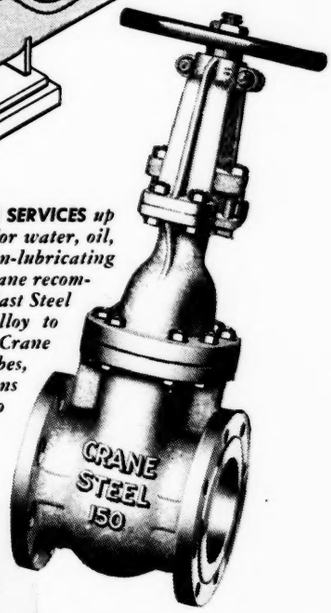
Take This Pressure Reducer Station, for example. Here Crane piping equipment meets the need just as it does for any power, process or general service installation. For the Crane line of valves, fittings, pipe and accessories is the world's most complete. You can select everything from one catalog . . . get everything on one order to your local, well-stocked Crane Branch or Wholesaler.

Power men have long recognized the value of standardizing on Crane, the **One Source of Supply** complete enough to simplify every piping procedure. **One Responsibility** for materials helps to assure a better installation, avoids confusion and needless delays. And for **High Quality** in every piping item . . . and dependable performance throughout every piping system . . . get Crane Quality, unsurpassed for more than 90 years.

CRANE CO., 836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas



Typical piping installation at pressure reducer station. All materials available from Crane.



FOR SEVERE STEAM SERVICES *up to 850 deg. F., and for water, oil, air, gas and other non-lubricating fluids up to 500 deg. F.—Crane recommends No. 47XR 150-Pound Cast Steel Wedge Gate Valves with Exelloy to Nickel Alloy seating. Complete Crane line of steel valves includes gates, globes, angles and checks . . . in all patterns and sizes . . . in pressure classes from 150 to 1500 pounds. Screwed, flanged or welding ends. Sizes to 24-in. See your Crane Catalog.*

EVERYTHING FROM . . .

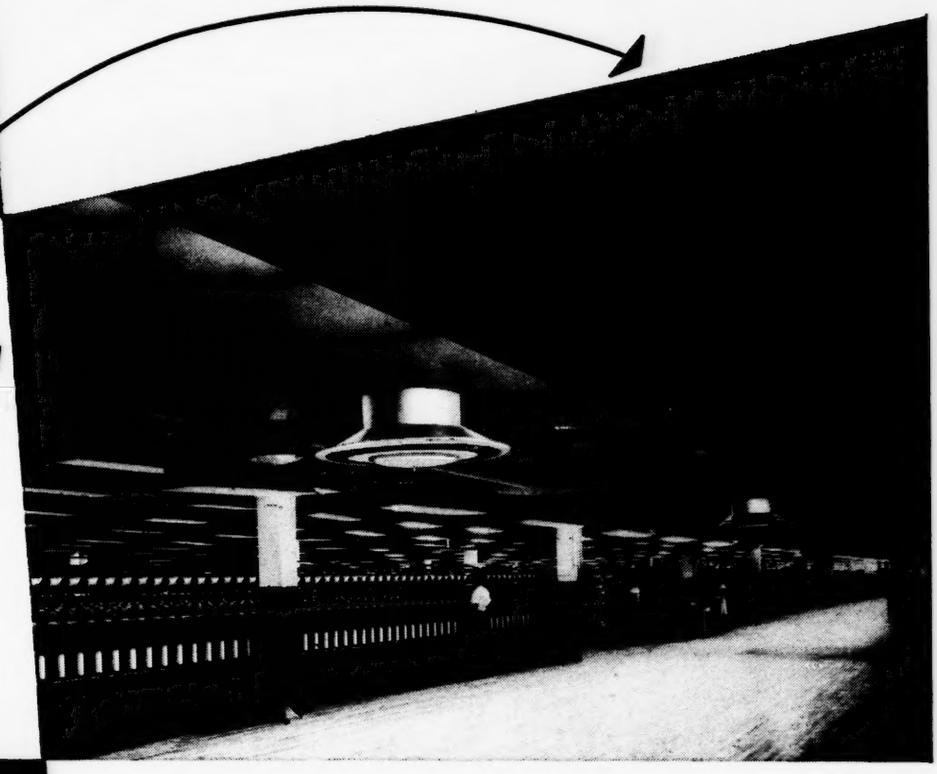
VALVES • FITTINGS
PIPE • PLUMBING
AND HEATING

CRANE

FOR EVERY PIPING SYSTEM

Views of the new Celriver Plant of Celanese Corp. of America near Rock Hill, S. C., in which 409 Kno-Draft Diffusers are installed.

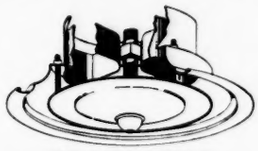
Carrier Corporation, Air Conditioning Engineers and Contractors



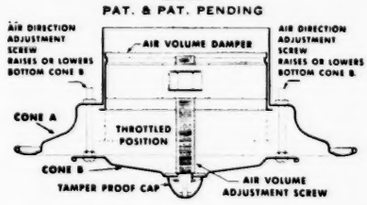
Kno-Draft

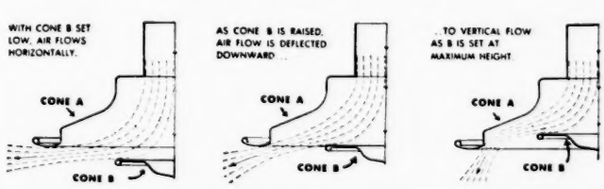
. . . the completely adjustable Air Diffusers chosen again by Celanese Corporation for another large new plant.

With features like these, adjusting and balancing is a matter of a few minutes.



PAT. & PAT. PENDING


AIR DIRECTION ADJUSTMENT SCREW RAISES OR LOWERS BOTTOM CONE B
AIR VOLUME DAMPER
AIR DIRECTION ADJUSTMENT SCREW RAISES OR LOWERS BOTTOM CONE B
CONE A
THROTTLED POSITION
CONE B
TAMPER PROOF CAP
AIR VOLUME ADJUSTMENT SCREW


WITH CONE B SET LOW, AIR FLOWS HORIZONTALLY.
CONE A
CONE B
AS CONE B IS RAISED, AIR FLOW IS DEFLECTED DOWNWARD
CONE A
CONE B
TO VERTICAL FLOW AS B IS SET AT MAXIMUM HEIGHT
CONE A
CONE B

For complex operating conditions that put air diffusers to a real test, few installations surpass a modern textile plant. Here air distribution is a vitally important part of quality control. Many processes require positive temperature and humidity control to within 1 degree. High-speed textile machinery develops hard-to-handle heat gain patterns. Myriads of winding threads require the absolute elimination of drafts. Kno-Draft air diffusers have been chosen repeatedly for Celanese plants because a succession of installations have proved their ability to meet the most critical operating conditions.

Kno-Draft facility for delicate regulation of air volume and direction enables air conditioning engineers to produce precisely the air pattern best suited for each area, even to blanketing a source of heat generation where necessary. And since Kno-Draft diffusers can be adjusted *after installation*, engineers are able to change the air distribution pattern whenever people, partitions, or processes are relocated.

SEND COUPON for handbook containing complete information on Kno-Draft Diffusers and all the necessary installation data.

W. B. CONNOR ENGINEERING CORP.

Air Diffusion • Air Purification • Air Recovery

112 East 32nd Street — CONNOR — New York 16, N. Y.

IN CANADA: Douglas Engineering Co., Ltd., 190 Murray Street, Montreal 3, P. Q.

W. B. CONNOR ENGINEERING CORP.

Dept. E-90, 112 East 32nd Street, New York 16, New York

Please send my FREE copy of the new Kno-Draft Handbook on Adjustable Diffusers.

Name.....

Position.....

Company.....

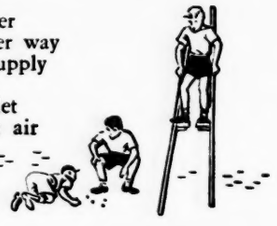
Street.....

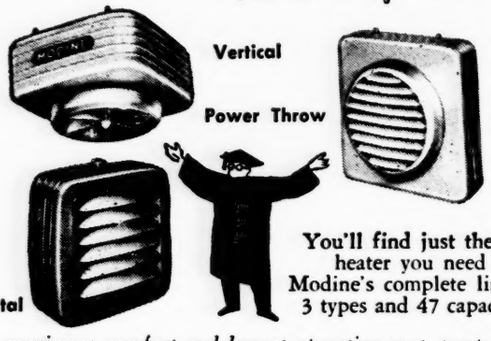
City.....Zone.....State.....

What makes the difference in Unit Heaters?

DISCHARGE AIR TEMPERATURE*

Mibs shooter or stilt walker — you're comfortable either way if Modine Unit Heaters supply the heat. Modine's *right* combination of correct outlet temperature and sufficient air velocity heats all parts of a room uniformly, even in coldest weather.



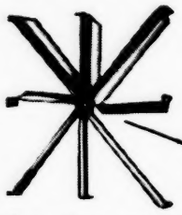


You'll find just the unit heater you need from Modine's complete line of 3 types and 47 capacities.

**For maximum comfort and lowest operating cost, temperature of air leaving unit heater should be between 110°-120°F. at standard conditions.*

LOWER COSTS

Fuel bills drop when you heat with Modine Unit Heaters. Modine's sufficient air velocity and correctly related outlet temperatures combine to deliver heat down into comfort zones where it's needed . . . don't waste it on ceilings or above heads of room occupants.



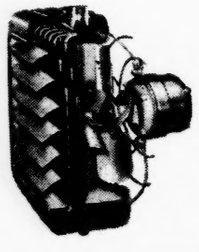
Built-in velocity generator increases heat throw *without increasing power costs* . . . lets large share of warm outlet air disperse cold air near floor.

Modine gives you lower power and motor maintenance costs, too, by using only high-quality, totally enclosed split-phase or capacitor motors on all but smallest unit heater models.

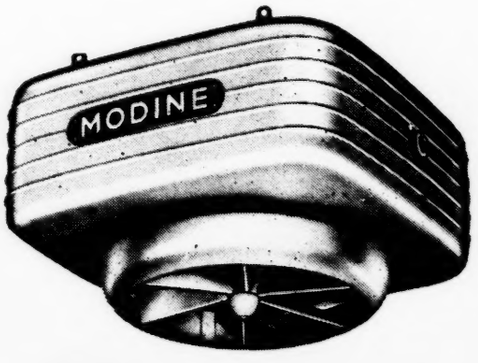
LONGER LIFE

Modine Unit Heaters last longer. One exclusive feature, Parker-Bonderizing, protects casings and sheet metal parts against formation and spread of rust . . . anchors paint to steel . . . prolongs original attractive finish.

Entire condenser of pure copper and copper alloy gives you maximum resistance to electrolysis and corrosion.



Controlled brazing results in one-piece, integrated coil construction, eliminating all weak spots. What's more, Modines have no screwed or expanded joints, no gaskets or bolts.

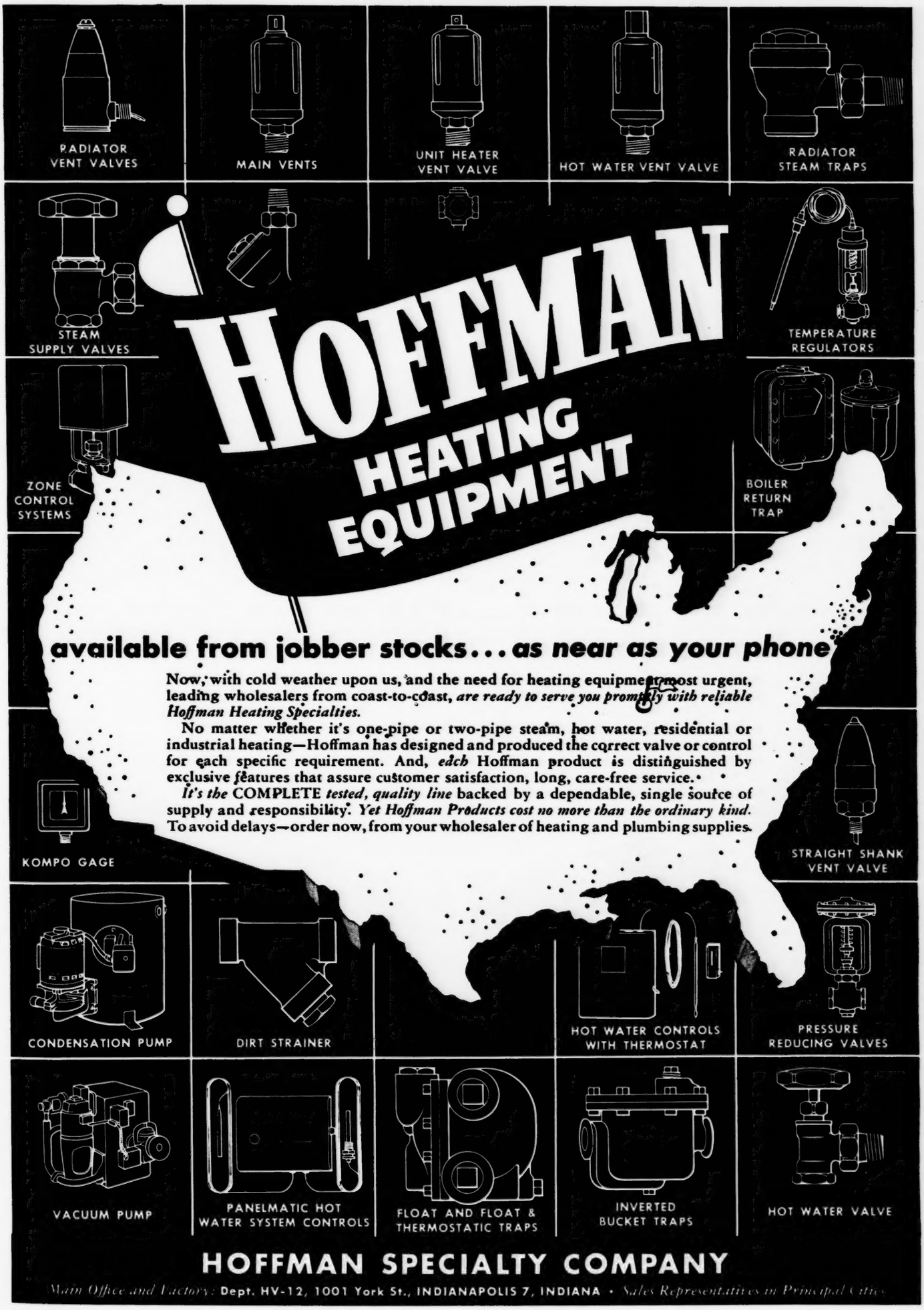


Modine
UNIT HEATERS

Yes . . . look beyond BTUs when buying Unit Heaters. Look to Modine! You can get all the facts by calling your nearest Modine Representative. He's listed in the classified section of your phone book. Or write direct. Modine Mfg. Co., 1511 Dekoven Ave., Racine, Wisconsin.

Ask for the new Modine Unit Heater Bulletin 149-A. Also available on special request is the informative booklet — "Here's How to Evaluate Operating Characteristics of Suspended Unit Heaters." Send for them today!

U-1043


RADIATOR VENT VALVES
MAIN VENTS
UNIT HEATER VENT VALVE
HOT WATER VENT VALVE
RADIATOR STEAM TRAPS
STEAM SUPPLY VALVES
TEMPERATURE REGULATORS
ZONE CONTROL SYSTEMS
BOILER RETURN TRAP
HOFFMAN
HEATING EQUIPMENT
available from jobber stocks... as near as your phone
Now, with cold weather upon us, and the need for heating equipment most urgent, leading wholesalers from coast-to-coast, *are ready to serve you promptly with reliable Hoffman Heating Specialties.*
No matter whether it's one-pipe or two-pipe steam, hot water, residential or industrial heating—Hoffman has designed and produced the correct valve or control for each specific requirement. And, *each* Hoffman product is distinguished by exclusive features that assure customer satisfaction, long, care-free service.
It's the COMPLETE *tested, quality line* backed by a dependable, single source of supply and responsibility. *Yet Hoffman Products cost no more than the ordinary kind.* To avoid delays—order now, from your wholesaler of heating and plumbing supplies.
KOMPO GAGE
STRAIGHT SHANK VENT VALVE
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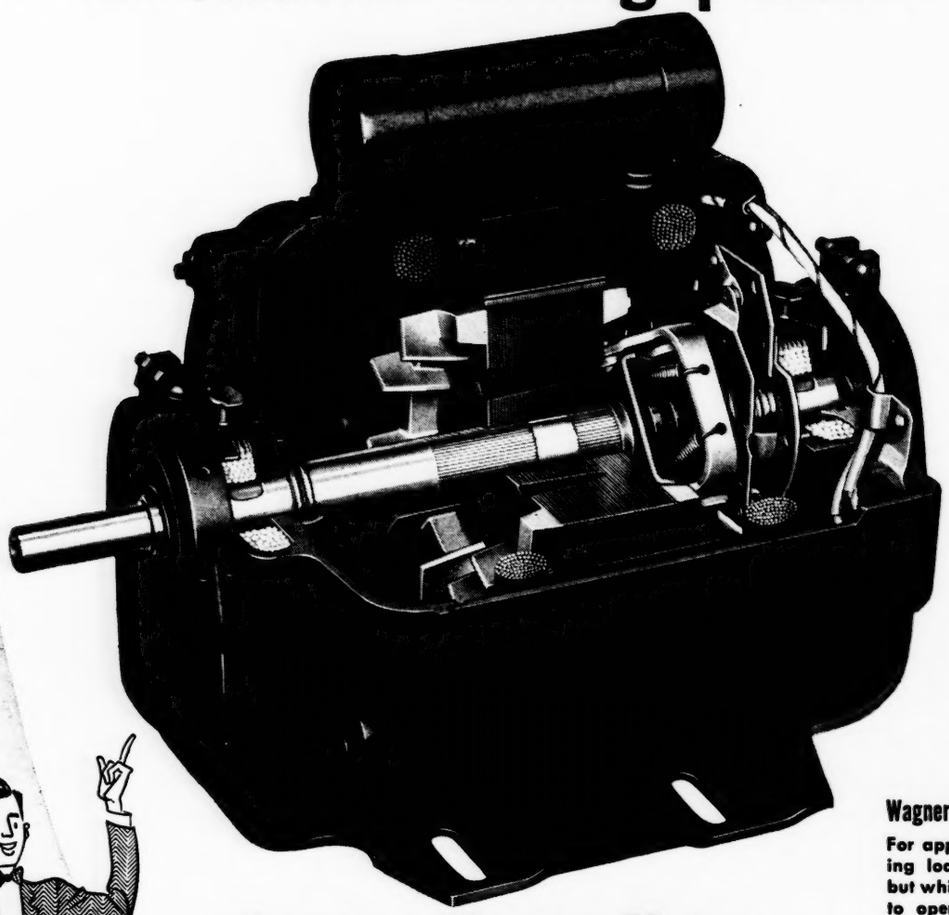
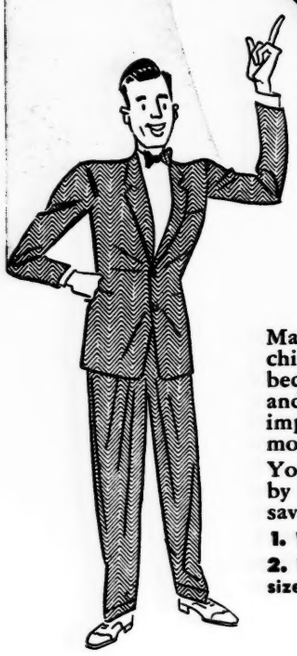
HOT WATER VALVE
HOFFMAN SPECIALTY COMPANY
Main Office and Factory: Dept. HV-12, 1001 York St., INDIANAPOLIS 7, INDIANA • *Sales Representatives in Principal Cities*

Give your product an *Added* selling point...



Wagner Capacitor-start Motor

For applications where starting loads are fairly heavy, but which can be brought up to operating speed quickly.



choose a Wagner Motor

for long life, dependability and nationwide service

Many manufacturers have powered their machines and appliances with Wagner Motors because of their *proven* reputation for long life and dependability . . . and because they *know* the importance of being able to provide immediate motor service when needed.

You can add a real selling point to your product by choosing Wagner Motors, too, and you'll save time, money, and worry because:

1. Wagner Motors are backed by a liberal warranty.

2. They are available in a wide range of types and sizes for every application.

3. Improved engineering features assure long life and efficient operation.

4. They are immediately available from Wagner Branches in all principal cities.

5. More than 450 Wagner Authorized Service Stations and Parts Distributors *plus* 25 Wagner-owned Service Branches provide on-the-spot service, replacement motors, or genuine repair parts.

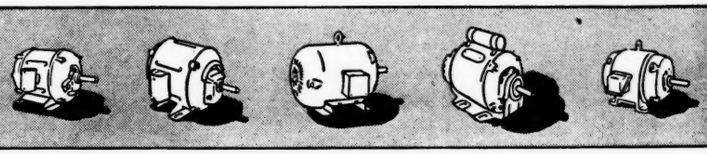
Regardless of what your motor requirements may be, Wagner can furnish a motor to fit your need. Bulletins on the complete line of Wagner Motors will be sent on request.

Wagner Electric Corporation

6463 PLYMOUTH AVE., ST. LOUIS 14, MO., U. S. A.

Consult Wagner Engineers on all Electric Motor Problems

Wagner Electric Corporation EST. WE 1891



M49-13

• ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE PRODUCTS •

Weirzin

TAKES PAINT EASILY—
HOLDS IT FAST

Paint stays put—and so do enamels, lacquers, varnishes and lithographic inks—on products made of durable Weirzin as supplied direct from Weirton in coils or cut lengths. Paint and other finishes, once applied, are there to stay—safe from the marring effects of underfilm corrosion, which just cannot occur in Weirzin. Its tight malleable zinc coating, electrolytically applied, is integrally bonded to the steel—to remain intact through manufacturing operations, and under all conditions of temperature and humidity.

WEIRTON STEEL CO.

WEIRTON, W. VA., *Sales Offices in Principal Cities*

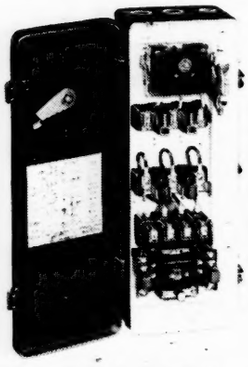
Division of **NATIONAL STEEL CORPORATION,** *Executive Offices, Pittsburgh, Pa.*

An office heating installation, using a Chrysler Airtemp automatic gas heating unit, combined with an installation of two Allen-Bradley Bulletin 712, Size 1, Form 2F combination starters and two Allen-Bradley Bulletin 800, Type R4SA push buttons.

Airtemp AIR-CONDITIONERS

equipped with

A-B Quality Trouble Free Motor Controls



Bulletin 712, Size 1, Form 2F, fused disconnect switch combination starter in a NEMA Type 1 general purpose enclosure. Note the generous wiring room and many knockouts.

WHY ARE ALLEN-BRADLEY STARTERS SO POPULAR for air-conditioning service? . . . Because they are trouble free. Only one moving part. No pivots, pins, or bearings to corrode or stick . . . no jumpers to break. You install them . . . and forget them!

NO CONTACT MAINTENANCE. Allen-Bradley patented silver alloy contacts never need cleaning, filing, or dressing.

DEPENDABLE OVERLOAD RELAYS. Allen-Bradley thermal relays are accurate and dependable even after long service.

The A-B trademark stands for millions of trouble free operations.

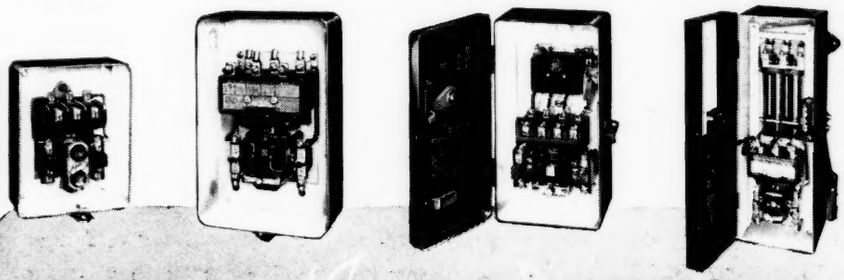
Allen-Bradley Co., 1330 S. Second St., Milwaukee 4, Wisconsin.

ALLEN-BRADLEY AIR-CONDITIONING AND REFRIGERATION CONTROLS

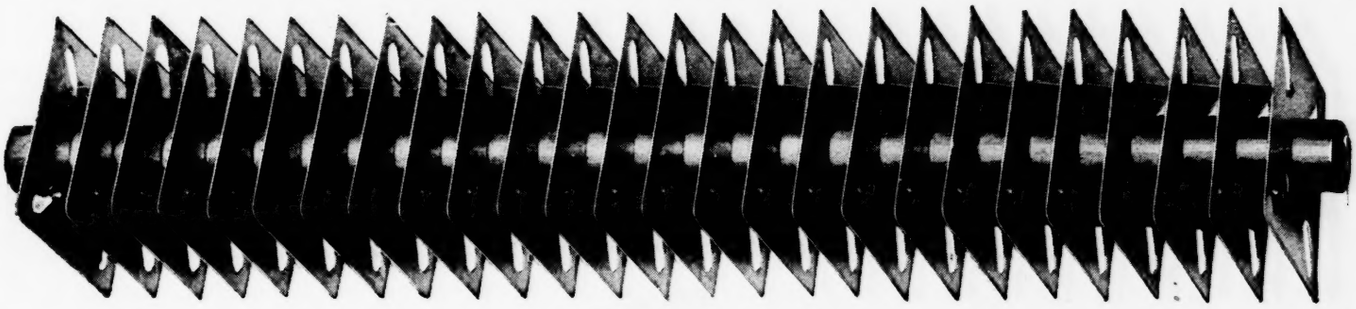
PRESSURE AND TEMPERATURE CONTROLS

High-pressure cutout and motor starter in same enclosure. Temperature controls can be mounted with motor starter in same way.

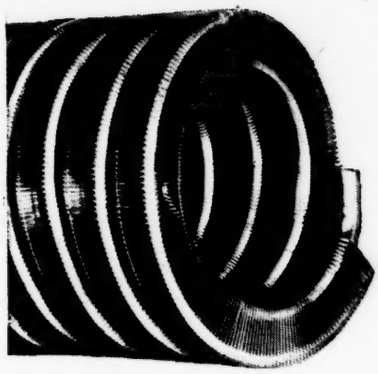
MANUAL STARTER | **AUTOMATIC STARTER** | **COMBINATION STARTER** | **HEAVY COMPRESSION STARTER**

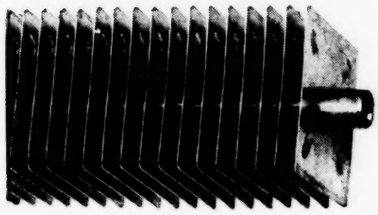


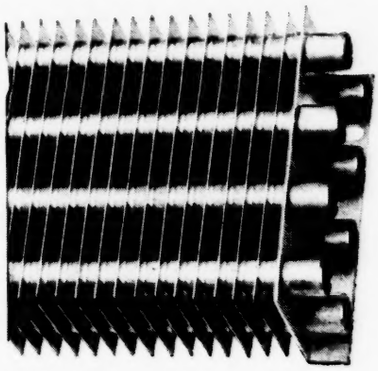
ALLEN-BRADLEY SOLENOID MOTOR CONTROL

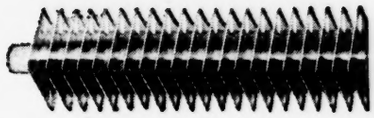


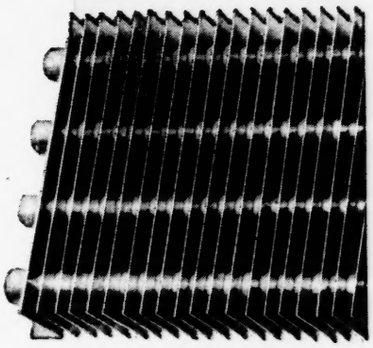
BUSH *Finned* TUBING

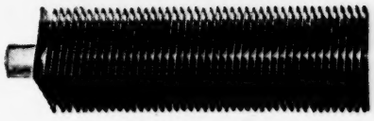


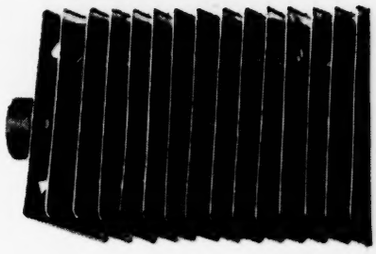












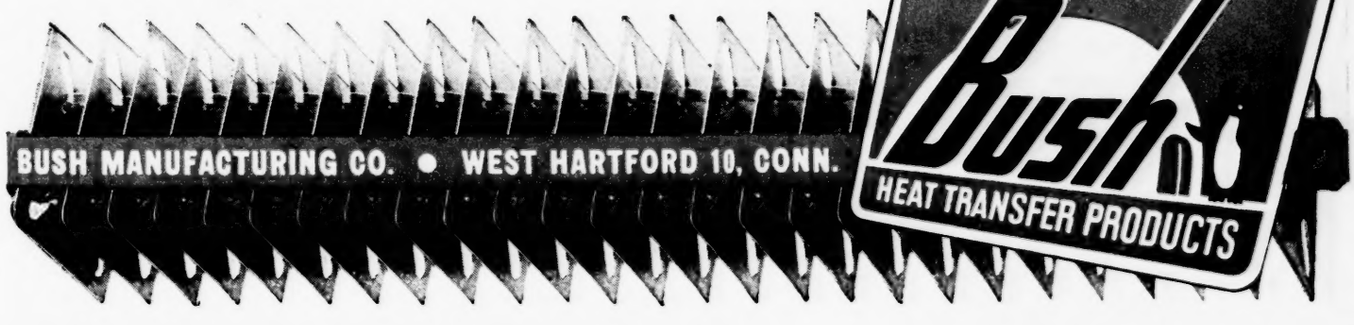
WANT TO heat a railroad train . . . or a bungalow . . . air condition a home . . . or a hospital . . . or freeze a mess of fish? Interested in steam, water or direct expansion coils . . . convectors . . . freezing coils?

No matter whether your heat transfer problem involves heating or cooling . . . you will probably find Bush finned tubing . . . with fins mechanically bonded to tubing for perfect contact and trouble-free operation . . . to be the most efficient, effective and economical answer.

The Bush Manufacturing Company . . . with more than forty years experience in the heat transfer field . . . is a pioneer designer and producer of this basic and fundamental element.

Bush expert engineers . . . in one of the largest and most up-to-date factories in the industry . . . and in conveniently located field offices . . . will be glad to help you with the proper design and application of the particular type of finned tubing best suited to your need. And you can rely upon Bush production facilities to supply your requirements with exact adherence to quality standards and delivery dates.

Write today for a copy of the BUSH FINNED TUBING SPECIFICATION SHEET— *address* DEPT. C8



Carl Amundson

OF HERMAN NELSON

Carl H. Amundson, manager of Herman Nelson's branch office in Milwaukee, Wisconsin, has been with the company since 1939. A graduate in engineering from the University of Wisconsin, Mr. Amundson is widely known among architects, engineers, contractors, and school authorities in his territory. At the opening of the war, he served with the War Production Board. Then he went to Alaska with a group of Herman Nelson Product Application Engineers to work with the Army Air Forces in the application of Herman Nelson Self-powered Heaters for preheating engines and cockpits of bombers. After the end of the war, he assumed managership of the Wisconsin territory.

Familiar with all types of heating and ventilating problems in industrial, commercial, and institutional buildings, are more than 75 Herman Nelson Product Application Engineers like Carl Amundson of Milwaukee. Each of them will furnish you with concise, easy-to-use engineering data and specifications backed by technical knowledge and practical experience.

Whether your heating or ventilating problem calls for unit heaters, unit ventilators, propeller fans or centrifugal fans . . . you'll find that the nearest Herman Nelson Product Application Engineer knows exactly how they should be installed to provide most efficient operation and maximum operating economy.

These men and more than 200 carefully selected Distributors and Stocking Jobbers, with personnel trained in the application of our products, make up Herman Nelson's nationwide sales and service organization.

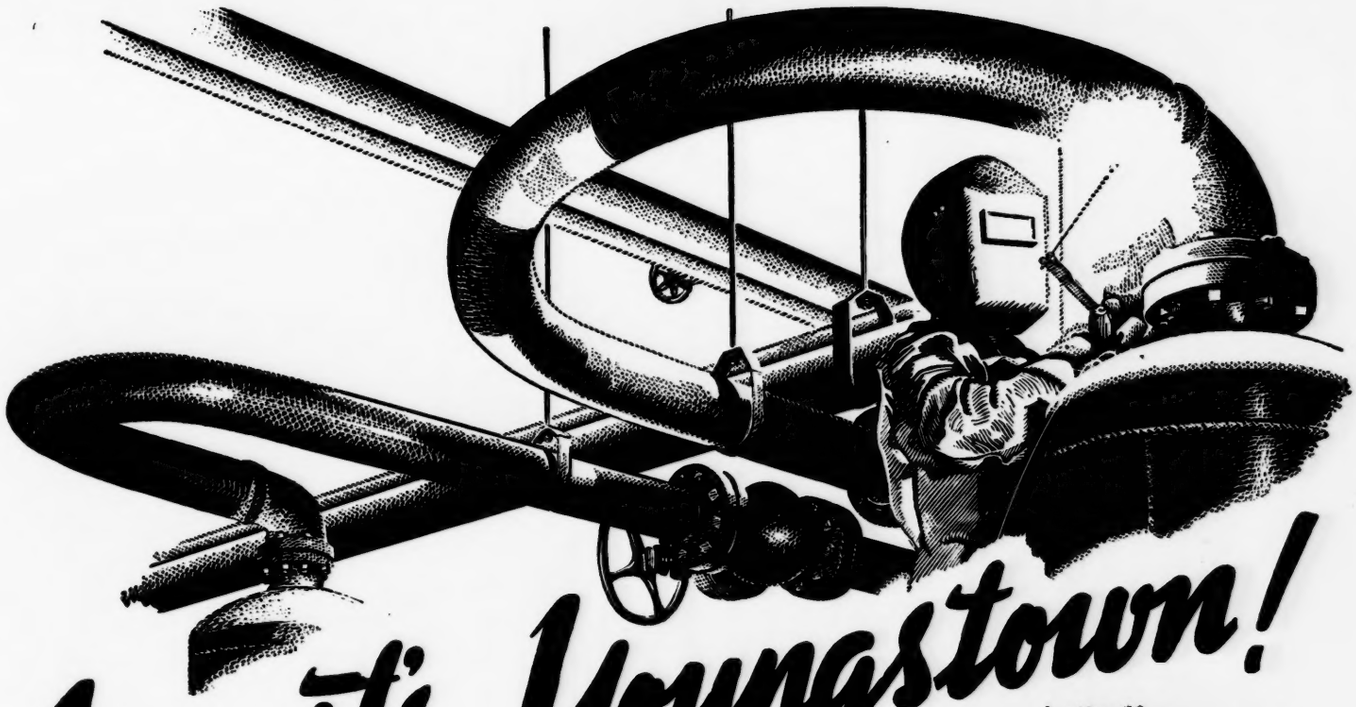
If you're interested in quality products and conscientious, intelligent service, contact Herman Nelson on your heating and ventilating problems.

herman nelson

THE HERMAN NELSON CORPORATION

Since 1906 Manufacturers of Quality Heating and Ventilating Products

MOLINE, ILLINOIS



Yes, it's Youngstown!

Dependable Steel Pipe ...Easy to Install

THROUGH the years, the guiding principle at Youngstown has been to make quality steel pipe which is well suited to serve the needs of plumbing and heating contractors and their customers. That's why Youngstown Pipe bends accurately, cuts readily, threads surely, welds easily--properties designed into the product for efficient fabrication, installation and long, satisfactory service.

Youngstown

STEEL PIPE

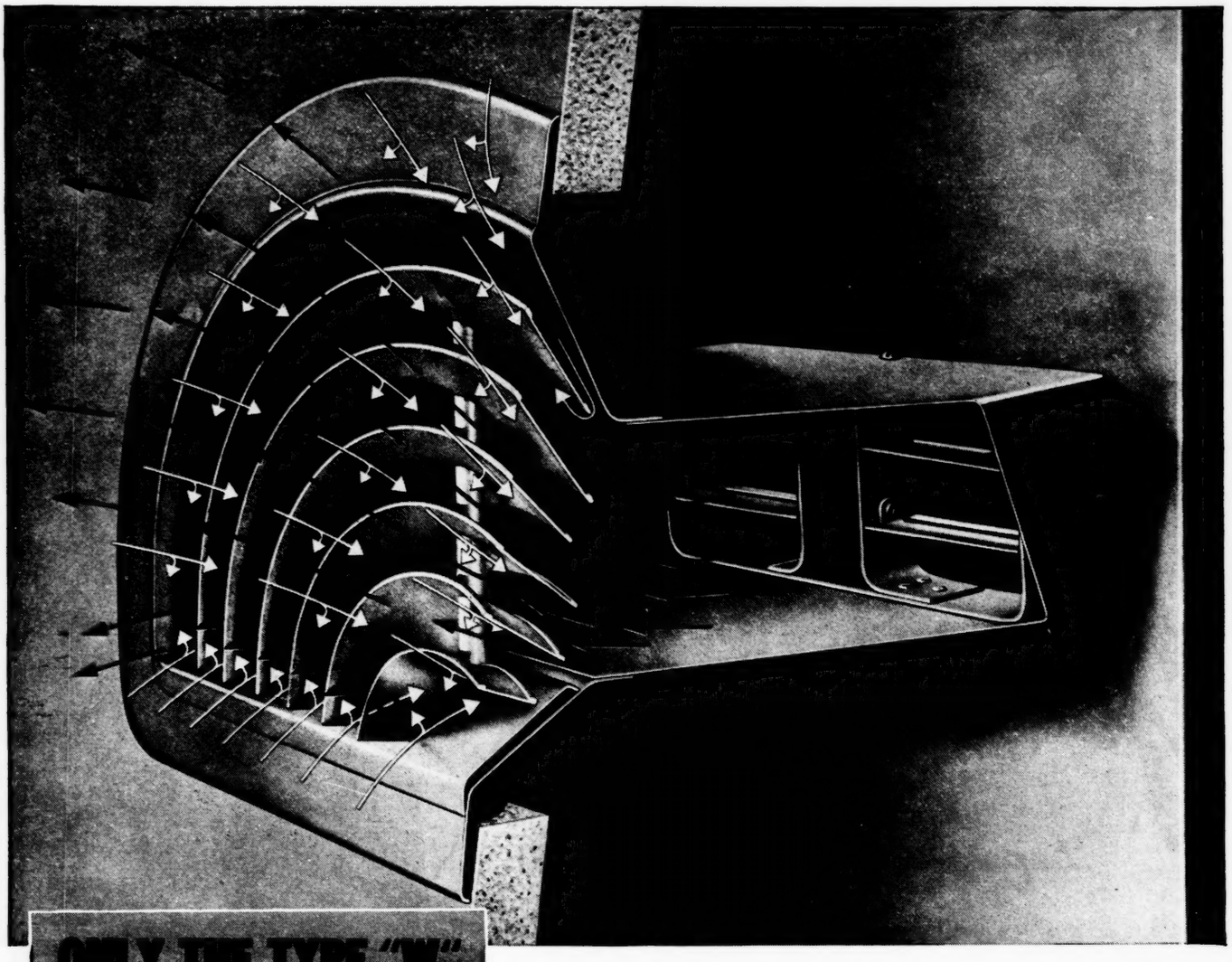
THE YOUNGSTOWN SHEET AND TUBE COMPANY

Manufacturers of Carbon, Alloy and Yoloy Steel

General Offices - Youngstown 1, Ohio

Export Office - 500 Fifth Avenue, New York

PIPE AND TUBULAR PRODUCTS - CONDUIT - BARS - RODS - COLD FINISHED CARBON AND ALLOY BARS - SHEETS - PLATES - WIRE - ELECTROLYTIC TIN PLATE - COKE TIN PLATE - RAILROAD TRACK SPIKES



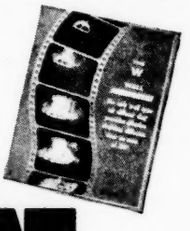
ONLY THE TYPE "W" ANEMOSTAT *Air Diffuser* PROVIDES *Draftless Air Diffusion* FROM WALL OUTLETS

To solve the air distribution problems resulting from air supply outlets located *on the walls*, instead of ceilings, Anemostat developed the Type "W" Wall Air Diffuser.

The Type "W" effectively diffuses air within an area of 180° by distributing it upward and outward *above the occupancy level.* Because the Type "W" aspirates or draws in room air and mixes it with supply air within the device, temperature and humidity are promptly equalized.

Furthermore, by reducing velocity through expansion, the Type "W" Anemostat handles any specified number of air changes without noticeable air motion. It projects a blanket of mixed air that gently spreads in a draftless pattern and assures true comfort in every part of the room.

For the full story on the Anemostat Type "W" Wall Air Diffuser write for Bulletin 27. The Anemostat Engineering Department or representative is always ready to assist you.



AC-1202

Anemostat Type "W" Wall Air Diffusers are available from stock for immediate delivery in sizes to handle all air requirements.

ANEMOSTAT

REG. U. S. PAT. OFF.

DRAFTLESS *Aspirating* AIR DIFFUSERS

ANEMOSTAT CORPORATION OF AMERICA
10 EAST 39th STREET, NEW YORK 16, N. Y.
REPRESENTATIVES IN PRINCIPAL CITIES

"No air conditioning system is better than its air distribution"

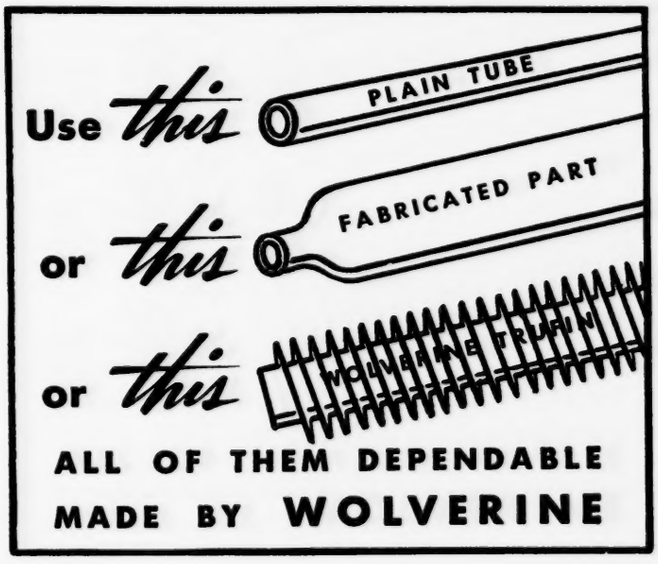
How to Reduce Manufacturing Costs

It's not always easy to put your finger on the exact places where economies in manufacturing can be affected.

Sometimes these economies are found outside your own manufacturing processes—among the assembled parts—brought in by suppliers of the various components making up your product.

If tubing or tubular parts form a part of the products you make—it's to your advantage to see that such components are supplied by specialists—specialists like Wolverine Tube, who have been manufacturing tubing exclusively for over thirty years. To draw on this wealth of experience means economies to you. We can help you (just as we have helped thousands of other manufacturers) to utilize tubing—plain, finned (Wolverine Trufin) or fabricated—in a way that can reduce your manufacturing costs. We have shown many manufacturers, for instance, how they could make their tubular parts more economically by using tube than by continuing with the method they were employing. We have also pointed out ways to substantial economies, where heat transfer is involved, through the use of Wolverine Trufin (the integral finned tube).

Wouldn't you like to learn more about these economies? Have one of our engineers call on you to discuss these matters. No obligation.



WOLVERINE TUBE DIVISION
CALUMET AND HECLA CONSOLIDATED COPPER COMPANY
INCORPORATED
MANUFACTURERS OF SEAMLESS NON-FERROUS TUBING
1417 CENTRAL AVENUE • DETROIT 9, MICHIGAN

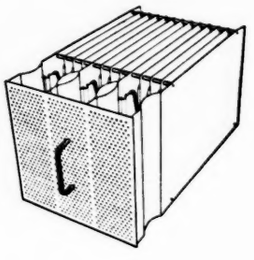
Only Electromaze gives you these big improvements in electric air filtering!

Any electrostatic precipitator will give you super clean air—remove even smoke and other invisible, sub-micronic particles. But the new Electromaze goes further—gives you dozens of exclusive features that increase operating efficiency and simplify lay-out, installation and maintenance. For details, see below. For the complete story, see your nearby Air-Maze representative. Air-Maze Corporation, 5200 Harvard Avenue, Cleveland 5, Ohio.

P.S. When planning improvements in air filtration be sure to call in your consulting engineer. His lifetime experience is yours for the asking. And you can act on his recommendations with confidence.

IONIZER AND COLLECTOR IN SINGLE CELL

Use of a single high voltage in both ionizer and collector permits unitized construction. Each cell is a complete filter in itself. All aluminum plate construction resists corrosion. Light and easy to handle. A standard cell 12″ high by 12″ wide weighs only 20¾ lbs.!

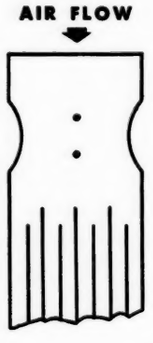


"DESK DRAWER" DESIGN

Cells (as well as rectifier) slide in and out of frames like desk drawers—automatically make or break electrical connection. Can instantly be removed for inspection, servicing or replacement. All high voltage wiring is *inside* duct because power pack is part of filter assembly. Easier to install.

"BUILDING BLOCK" INSTALLATION

Treated steel frames bolt together in a jiffy to form banks built like a skyscraper. Your choice of any combination of cells 4″ x 12″, 8″ x 12″ or 12″ x 12″ permits installation in restricted spaces.



DUAL IONIZATION

Two ionizing wires instead of one insure maximum charging of dirt particles. Double protection in case of wire breakage. Smaller diameter wire practically eliminates dirt build-up, insuring maximum efficiency at all times.

EASIER SERVICING

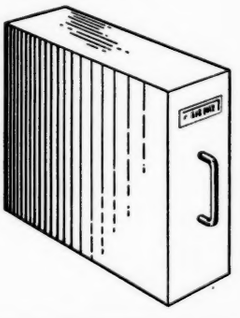
"Desk drawer" cells may be cleaned while in place with ordinary city water pressure

or

where no drain or water connection is available, cells may be quickly removed, cleaned and oiled in separate tank.

SELF-ADJUSTING POWER SUPPLY

Exclusive phase-shifting "Monocyclic" network controls rectified output voltage by controlling input current. Automatically compensates for normal line fluctuations, minimizes normal spark-over occurrence. Maintains optimum filtering efficiency during entire dirt-collecting period. Provides full protection against even a complete short circuit.



AIR FILTERS
SILENCERS
SPARK ARRESTERS

AIR-MAZE

THE FILTER ENGINEERS

LIQUID FILTERS
OIL SEPARATORS
GREASE FILTERS

—it's easier and better the WeldELL® way—

"Taylor Forge has thought of everything!"

A construction superintendent said it, but it has been expressed in one way or another by thousands of men who have lived and worked with Taylor Forge Welding Fittings and compared them with all other makes.

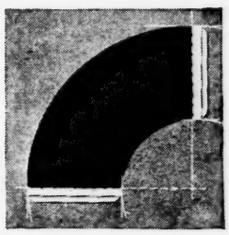
From the very start, Taylor Forge did the improving: set up a rigid, seemingly unattainable set of specifications for ideal welding fittings long before they were produced on a commercial scale.

But it was easier to think of everything than to accomplish it. Only the knowledge that Taylor Forge had accumulated, only the forging skills that Taylor Forge had developed, could have produced welding fittings that please alike the men who design piping, the men who erect piping, and the men who pay the bills.

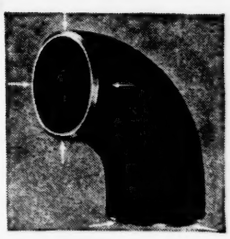
Today in the WeldELL line, you have the fittings that *ask* for comparison. Some of their plus-value features—features that are combined in no other fittings—are pointed out here. Remember that the plus-value line is also the broadest line! Coupon brings catalog.

Taylor Spiral-Weld Pipe is again promptly available in a broad range of sizes and thicknesses. Coupon brings new Spiral Pipe Bulletin 493.

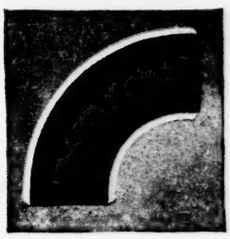
1 Seamless throughout



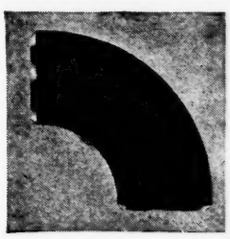
2 Sized end-tangents



3 Precision quarter-markings

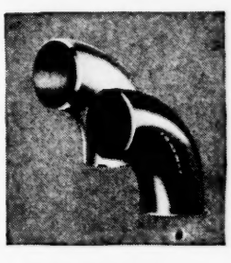


4 Engineered for full strength



5 Clear and complete identifications

6 Machine-tool bevels and lands



7 All materials: carbon and alloy steels; corrosion resistant alloys.

8 World's widest range of sizes, types, weights.

TAYLOR FORGE TF

TAYLOR FORGE & PIPE WORKS P. O. Box 485, Chicago 90, Ill. • Eastern Plant: Carnegie, Pa. • Western Plant: Fontana, Calif. • District Offices: New York, Philadelphia, Pittsburgh, Houston, Los Angeles, Chicago.

☐ Please send new Catalog 484 covering welding fittings and forged steel flanges.

☐ Send new Bulletin 493 covering Taylor Spiral-Weld Pipe and related fittings.

Name_____

Position_____

Company_____

Street Address_____

City_____ Zone____ State_____

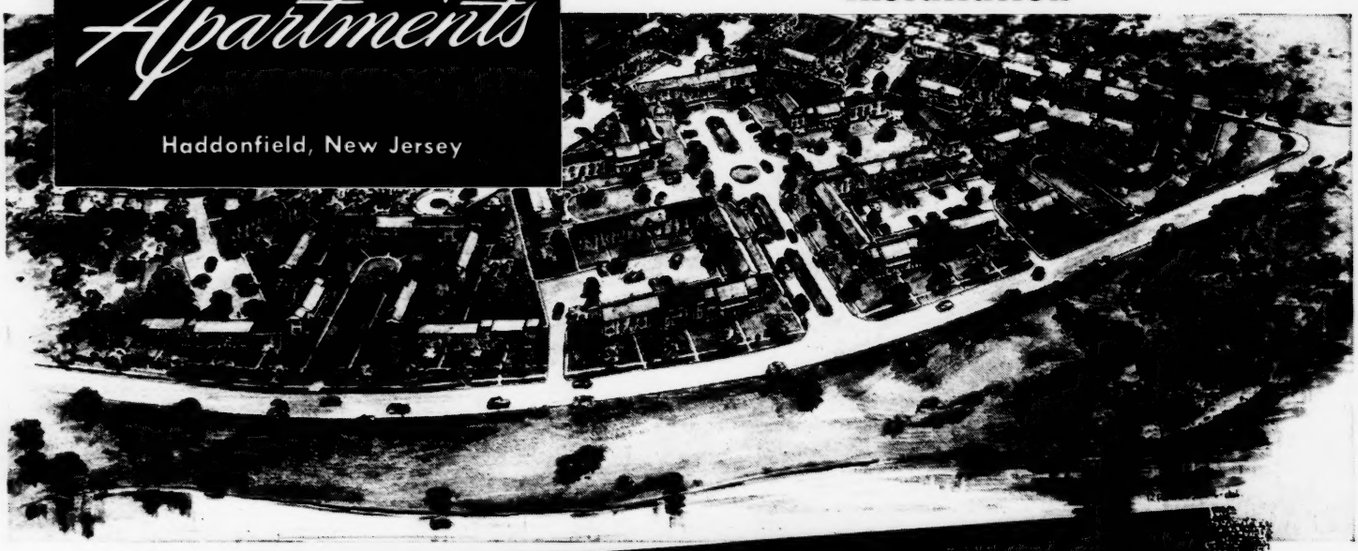
Mail to Taylor Forge & Pipe Works, P. O. Box 485, Chicago 90, Ill.

511-1249

Parkway Apartments

Haddonfield, New Jersey

Another B & G *Hydro-Flo* HEATING Installation



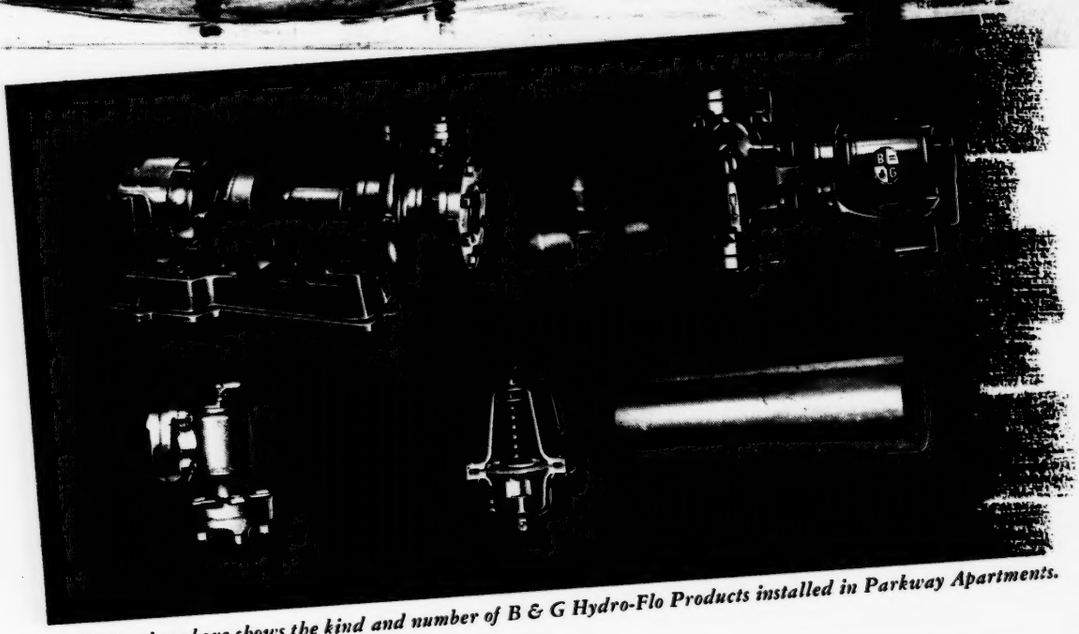


Illustration above shows the kind and number of B & G Hydro-Flo Products installed in Parkway Apartments.

Owner:
Parkway Apartments, Inc.
Haddonfield, N. J.

Architects and Engineers:
Edwards & Green
Camden, N. J.

Builder:
Edwards Building Co.
Delaware Township, N. J.

Heating Contractor:
Herman Goldner Co.
Philadelphia, Pa.

Soon to be completed, this modern housing project provides shelter for 362 families. The selection of B & G *Hydro-Flo* Heating was prompted by the well-known comfort-economy advantages of this system.

The project is divided into eleven groups of buildings with a boiler room for each group. Trunk supply and return mains run the length of each group, with Monoflo single mains led into the individual four-family buildings. Mains are copper tubing with B & G Copper Monoflo Fittings on both the supply and return risers to the convectors.

Here again is another demonstration of the universal application of B & G *Hydro-Flo* Heating. Cottage, apartment, commercial or industrial building—all are more comfortably and economically heated with this modern forced circulation hot water system.

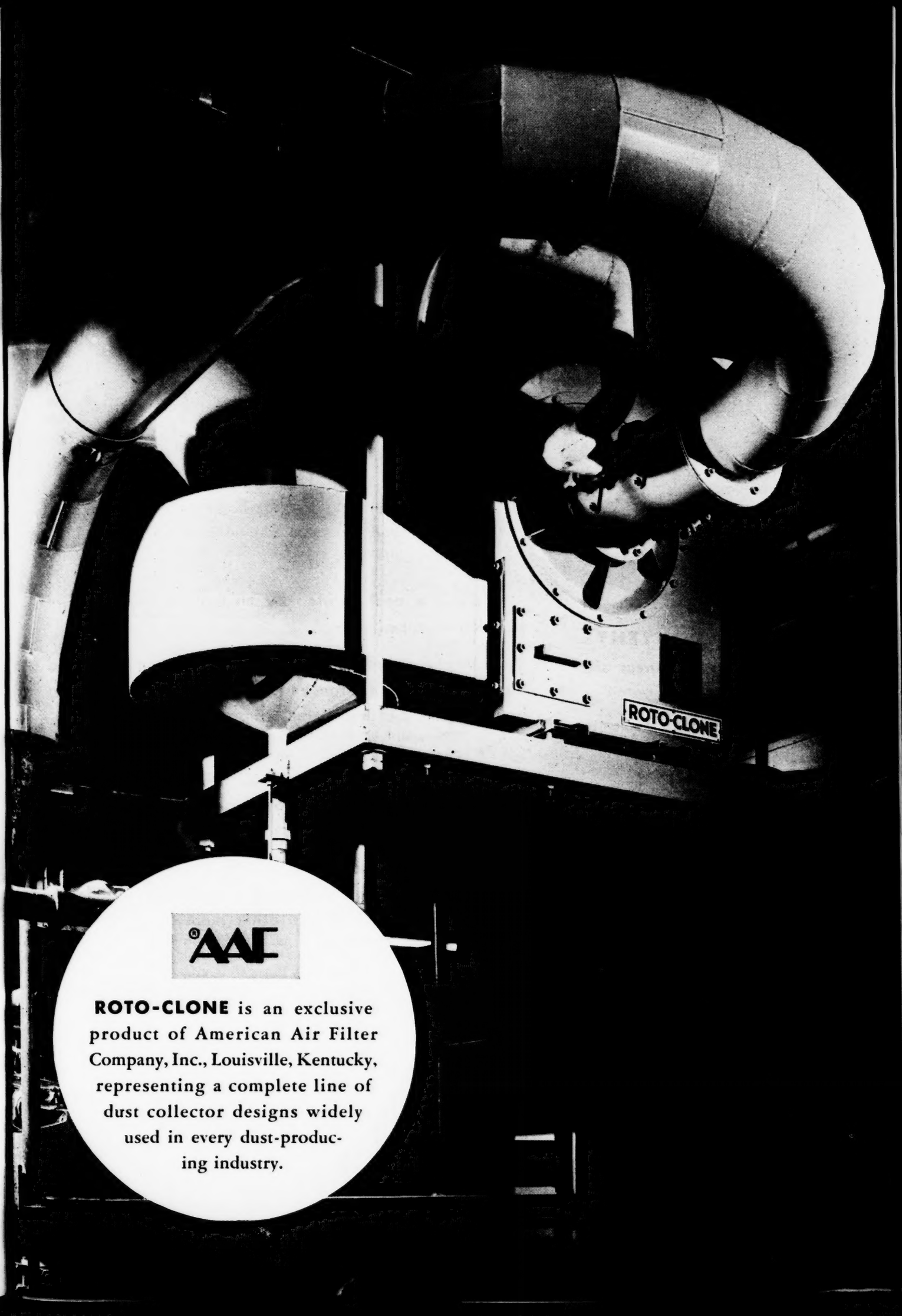
Write today for full information

"Capture the Sun with B & G *Hydro-Flo* Heating" presents the colorful story of this forced hot water system . . . the B & G Catalog gives you complete product data. Send for your copies.

BELL & GOSSETT Company

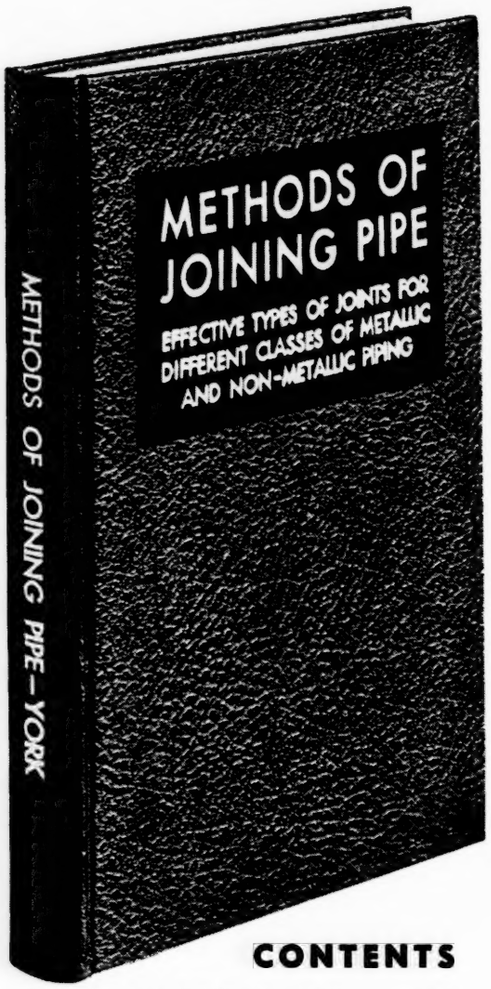
Dept. BG-4, Morton Grove, Ill.

*Reg. U. S. Pat. Off.



AAF

ROTO-CLONE is an exclusive product of American Air Filter Company, Inc., Louisville, Kentucky, representing a complete line of dust collector designs widely used in every dust-producing industry.


METHODS OF JOINING PIPE
EFFECTIVE TYPES OF JOINTS FOR DIFFERENT CLASSES OF METALLIC AND NON-METALLIC PIPING
METHODS OF JOINING PIPE—YORK

Just Published

A 236-page treatise covering all types of standard and special joints for pipe, illustrated by 249 drawings.

METHODS OF JOINING PIPE

by J. E. YORK
Building Service Engineer
Stone & Webster Engineering Corp.

Here is a book written by an experienced engineer who knows pipe joints.

It explains briefly and clearly the advantages and disadvantages of a large variety of joints for connecting both metallic and non-metallic pipe lines.

You will find illustrated descriptions of joints for cast iron, copper, brass, Duriron, lead, chemical tile, vitreous tile, stoneware, Transite, wood, glass, synthetic resin, plastic and concrete pipe.

You will also find joints applicable to piping systems for hot or cold water, brine, refrigerants, gases, distillates, chemical solutions, acids and other fluids.

CONTENTS

1. Screwed Joints for Ferrous and Brass Pipe
2. Flanged Pipe Joints
3. Welded and Brazed Pipe Joints
4. Methods of Joining Cast Iron Pipe
5. Joints for Thin-Walled Tubes
6. Joints for Plumbing and Chemical Resistant Pipe
7. Joints for Vitreous Tile and Concrete Pipe
8. Joints for Transite Pipe
9. Joints for Wood Pipe
10. Joints to Permit Movement

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Send me a copy of METHODS OF JOINING PIPE—Price, $3.00, which I enclose. I have the right to return the book within 5 days If not satisfied and my money will be refunded. (Please add 40¢ postage for Canadian or foreign orders.)

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*This information will be appreciated for our records. H&V-12/49

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Postpaid in United States

6-ROOM NEW JERSEY RESIDENCE USES CHASE COPPER TUBE FOR RADIANT HEATING

Floor installation of Chase Copper Tube for radiant heating in small home. Long 60- and 100-ft. lengths of tube eliminate many costly connections. Architect: Galloway & Henry, Westfield. N. J. Heating Contractor: T. J. De Chellis, Westfield, N. J.

Here's why

you, too, will want Chase copper tube in your Radiant Heating Installations!

- EASY TO BEND
- LONG LIFE
- LONG LENGTHS
- SOLDERED FITTINGS
- LOW COST
- LIGHT IN WEIGHT
- SMALL DIAMETERS

CHASE

IN the small home field, as well as the large, Chase Copper Tube for radiant heating has many outstanding features. One of these being L-O-N-G coils which reduce substantially the number of time-consuming connections ordinarily needed for this type work. What's more, its flexibility and lightness make it easy to handle... easy to shape and bend by hand. *No fittings are needed at bends.*

The BIG-7 points above tell you in a nut-shell why builders of big and small houses across the country are using Chase Copper Tube for radiant heating. And there's no shortage at Chase! Immediate delivery on big orders or small orders! For further information, let us send you "up-to-the-minute" booklet on planning and installing radiant heating.

SEND FOR FREE BOOKLET!

"Suggestions for Designing RADIANT PANEL HEATING with Copper Tube."

MAIL COUPON TODAY!

Chase Brass & Copper Co., Dept. HV-129
Waterbury 20, Conn.

Gentlemen: Please forward your "Suggestions for Designing Radiant Panel Heating with Copper Tube."

Name_____

Address_____

City_____ State_____

Chase

the Nation's Headquarters for
BRASS & COPPER

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THIS IS THE CHASE NETWORK . . . *handiest way to buy brass*

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ILLINOIS
Float & Thermostatic TRAPS

Assure *lower* return line temperatures

They're different!

–in construction

–in performance

ILLINOIS Float & Thermostatic Traps operate under vacuum with the same high efficiency as under pressure. No more water-logging of mains . . . no more air binding . . . end "morning overload" troubles. The instantaneous action of the condensate valve assures complete drainage of condensate. A separate thermostatically controlled valve vents air continuously in large volume, yet positively prevents loss of steam.

Recommended Applications

Low Pressure Heating Systems, Ventilating Units, Unit Heaters, Pre-Heaters, Re-Heaters, and other Fan System Heat Surface, Large Radiators or Pipe Coils, Hot Water Generators, Drips of Mains and Risers. Draining Coffee Urns, Warming Tables, Pasteurizers, Vacuum Pans, Heat Exchangers, Process Heaters, Sterilizers, Autoclaves, Cooking Kettles, Kilns and similar equipment.

(For operating ranges from 25 inches vacuum to 15 pounds pressure use Series G Traps. For pressures up to 50 pounds use Series MG.)

Rated capacities of various size traps from 200 pounds to 5000 pounds condensate per hour, at 2 pounds differential across the trap.

Positive, Instantaneous Valve Action . . . an Exclusive Feature

The Snap Action of the Condensate Control Valve assures efficient trap operation. The valve is not directly attached to float but is actuated by impact of the dropping float. Valve action is instantaneous whether the trap is handling its maximum capacity or only a trickle of condensate and regardless of variation in pressures. The valve is either wide open or tight shut—never cracked on seat, never hanging in an intermediate position. It is water-sealed at all times. It cannot chatter and is never affected by pulsations in the flow of condensate to the trap.

Simple, Compact, Trouble-proof

No ball floats to puncture or collapse—no toggles, pins, levers or hinges to corrode, stick or bend. Hard, stainless alloy steel renewable valves and seats are used for both condensate and air bypass units. Both valve units are at the top of trap out of dirt and sludge, assuring long life and satisfactory operation without attention. Straight through connections save head room, fittings, trenching, labor, and avoid low hung piping or lifts. Trap is easily opened for inspection without disturbing piping.

TRAP NOT DAMAGED BY FREEZING. Freezing will not harm this trap in any way and it is self-thawing.

Write for Bulletin 34-C

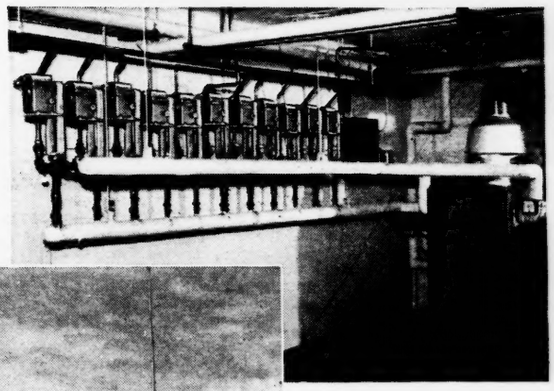
ILLINOIS ENGINEERING COMPANY
INCORPORATED 1900
RACINE AVENUE AT 21ST STREET • CHICAGO 8

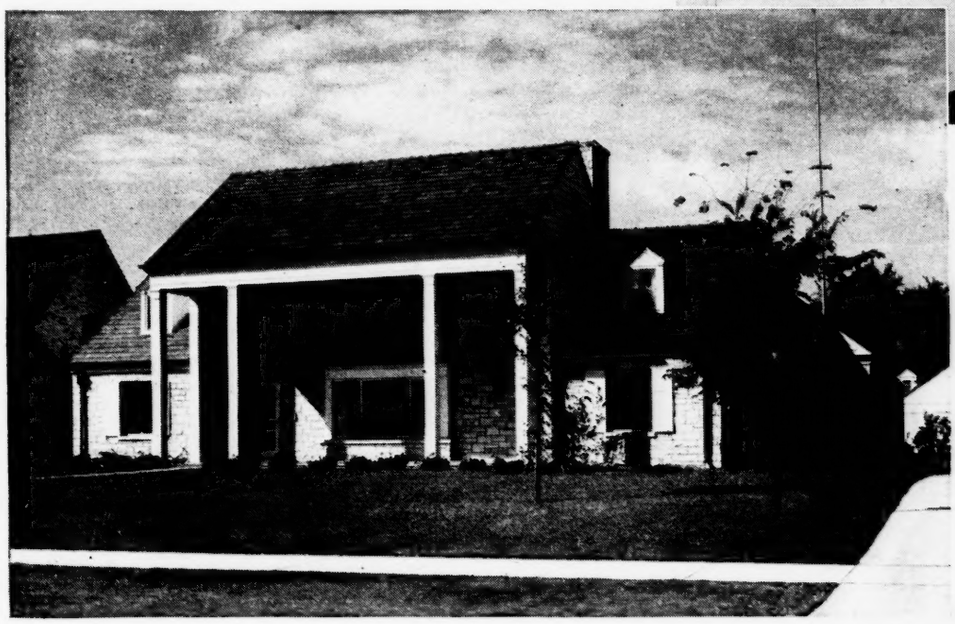
BARBER COLMAN

Engineered CONTROL SYSTEMS FOR PANEL HEATING

AN EXAMPLE OF INDIVIDUAL PANEL CONTROL

Engineering requirements for the residence shown below were that eleven panels be individually adjustable as to temperature, plus provision for varying the supply water temperature in accordance with weather changes. The resultant extensive control valve arrangement is shown at the right.





A Barber-Colman Control System was easily engineered to meet the complete needs of this fine residence for Ralph F. Anderson.

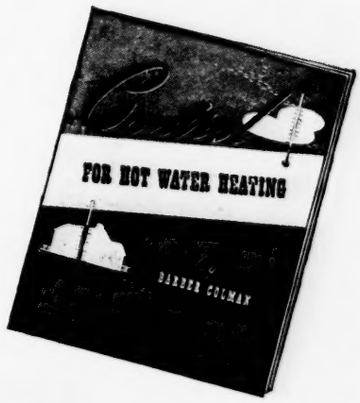
Architect:
Gilbert A. Johnson, Rockford

Engineer:
E. H. Burg, Rockford

Heating Contractor:
E. F. Newstedt, Rockford

BARBER-COLMAN EQUIPMENT IS AVAILABLE TO HANDLE ALL TYPES AND SIZES OF PANEL SYSTEMS

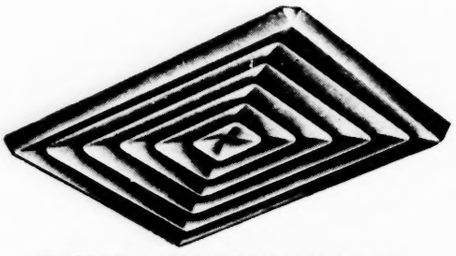
Don't let the control of panel heating systems baffle you! Barber-Colman Engineered Control Systems are available for any type of hot water heating. These systems may vary from full proportioning control of the hot water temperature in individual panels (as illustrated above) to a simple on-off control of the boiler-burner. Provision can be made for varying the boiler water temperature to compensate for changes in weather and to reduce annoying lags to a minimum. Over-riding controls can automatically take charge in extreme conditions. The important point you can remember is that Barber-Colman Controls are ready, to meet any requirements. They can be engineered into any desired kind of automatic control system. And — your Barber-Colman representative is ready to give full information and lend any needed engineering assistance.



BARBER-COLMAN COMPANY
1224 ROCK STREET • ROCKFORD, ILLINOIS

This bulletin will give you general ideas on the use of several different types of Barber-Colman Control Systems. Write for it today — ask for F-3157.

NATION-WIDE SALES AND ENGINEERING SERVICE

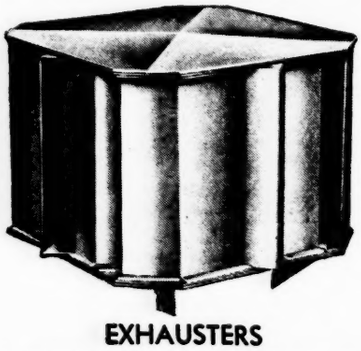


SQUARE AND RECTANGULAR AIR DIFFUSERS

Diffusion Pattern Control is in-built to permit 100% control of air distribution—with no drafts, no blank corners, no hot spots, no cold spots. Assembled from standard parts into any desired shape for ceiling, baseboard or sidewall installation.

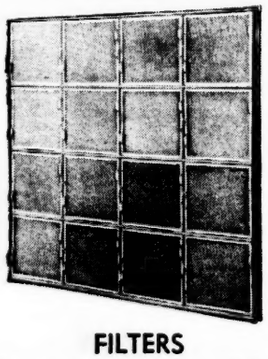
CIRCULAR AIR DIFFUSERS

Combine beautiful design with finest operating features to give rapid temperature equalization and draftless diffusion of air. In all sizes for all types of mounting and with lightning combinations.



EXHAUSTERS

Wind actuated. Exhaust up to 50% more air at average wind velocity. Will not seriously retard natural ventilation even with no breeze. Ideal for both gravity and mechanical air exhaust systems.



FILTERS

Filter 50% more air with greater efficiency at the high velocity of 432 F.P.M. In all types and sizes for air conditioning, ventilating and industrial applications.

Specify

AGITAIR

Your Assurance of QUALITY EFFICIENCY DEPENDABILITY

Write for Complete Literature

AIR DEVICES, INC.

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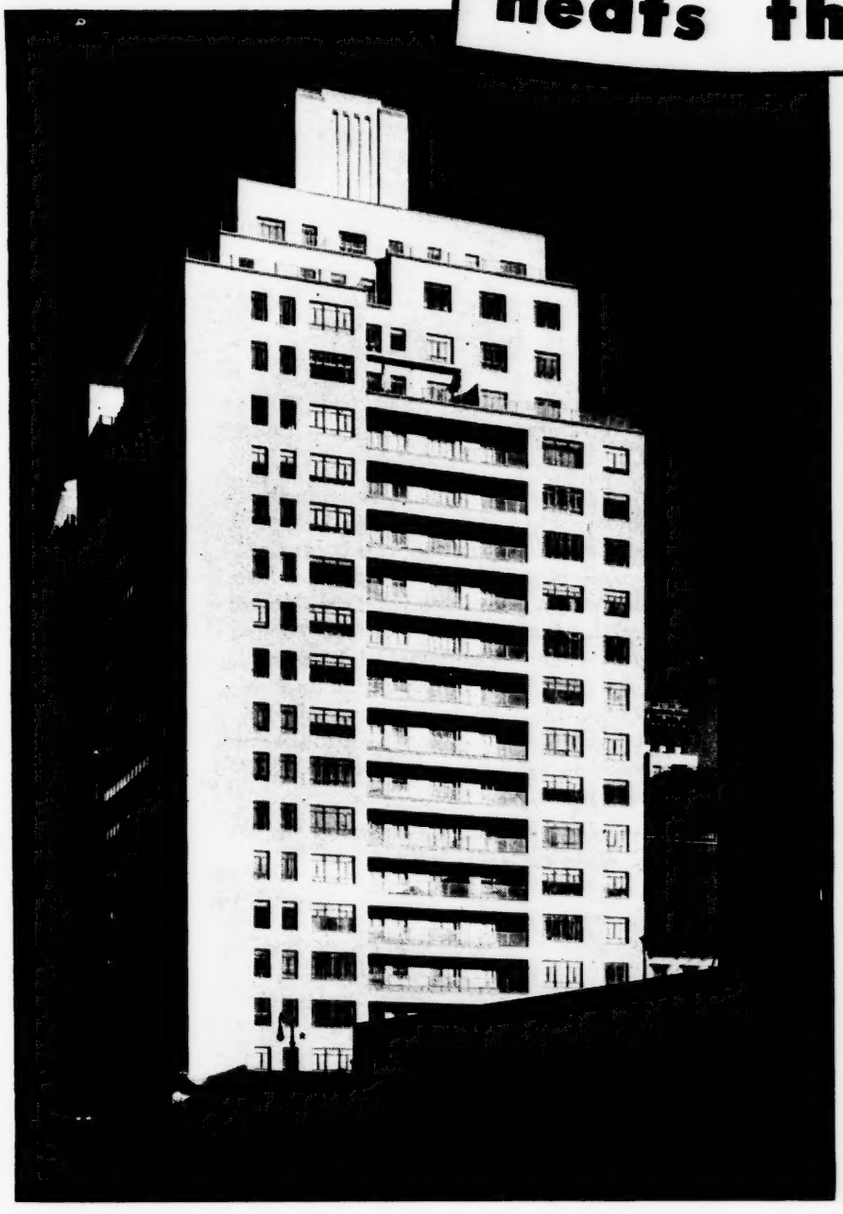
Serving the Heating, Ventilating, Drying and Air Conditioning Industries

FITZGIBBONS heats the big jobs!



Another New York City apartment building has FITZGIBBONS "D" TYPE Steel Boilers

This new eighteen-story and penthouse apartment now joins the ranks of many similar structures in enjoying the outstanding operating economy and complete satisfaction of tenants which are the traditional results of heat by Fitzgibbons steel boilers.

This new modern building containing 165 apartments at Second Avenue and Fifty-seventh Street, Manhattan, New York, N. Y.

Builder—*Samuel Rudin*
Architect—*Emery Roth & Sons*
Heating Contractor—*Raisler Corp.*

MEMBER
STEEL BOILER INSTITUTE
SBI
HEATING POWERS POWER

Reg. U.S. Pat. Off

MOST ECONOMICAL IN FUEL
1884
THE FITZGIBBONS BOILER

Reg. U. S. Pat. Off.

Two large 18,000 sq. ft. "D" Type oil-fired Fitzgibbons steel boilers serve this building, providing abundant heat and also hot water for all domestic purposes with the Fitzgibbons Tanksaver.* This is a series of copper coils submerged in the boiler which eliminates the need of a space consuming storage tank.

As a major aid to operating economies, profitable management and satisfied tenants, Fitzgibbons steel boilers are setting the pace everywhere.

*Reg. U.S. Pat. Off.

Fitzgibbons Boiler Company, Inc. H&V-DEC.

101 PARK AVENUE, NEW YORK 17, N. Y.

Send me the "D" TYPE Boiler Catalog.

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Address: .....

City: ..... Zone: ..... State: .....

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INDUCED DRAFT COOLING TOWERS

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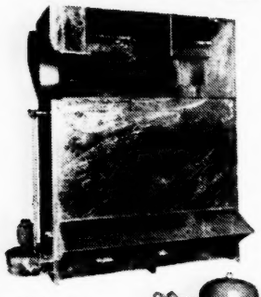

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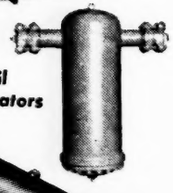

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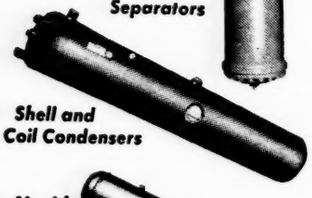

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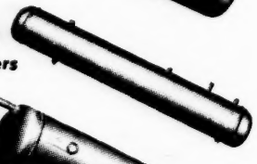

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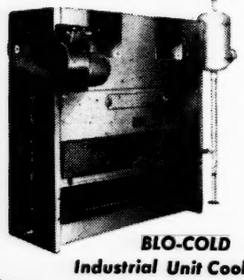

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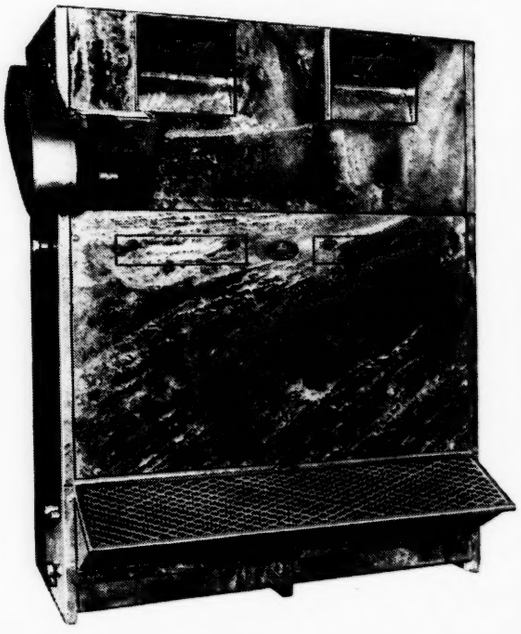

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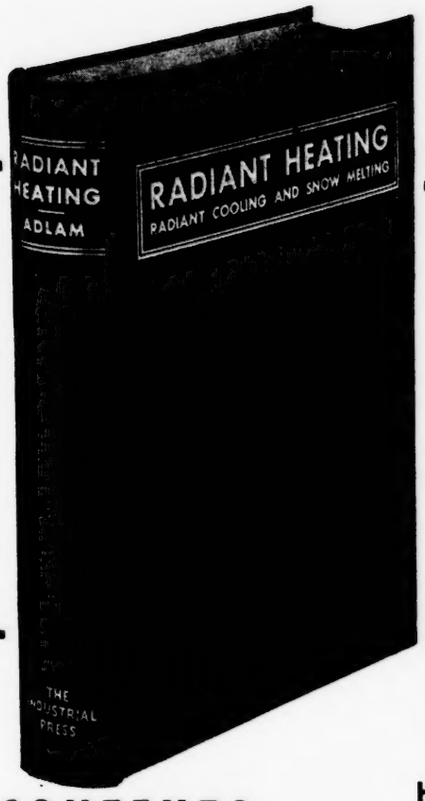

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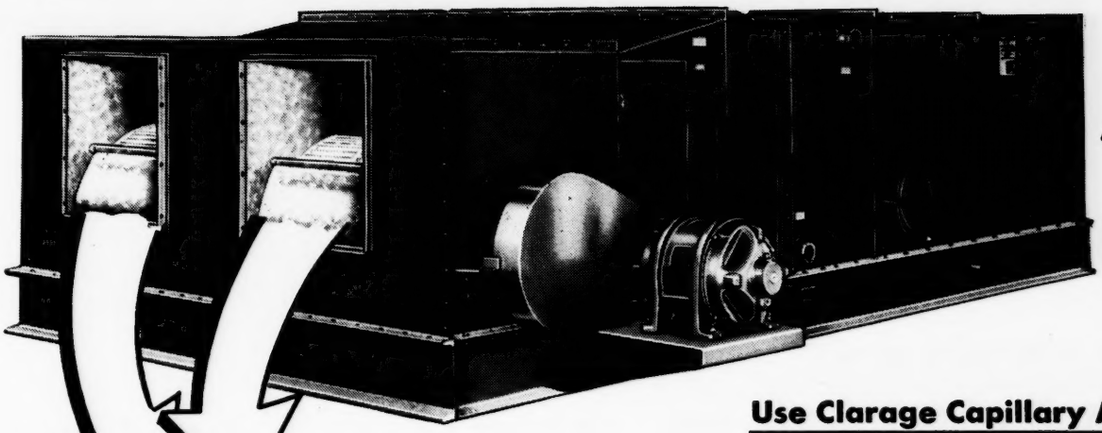

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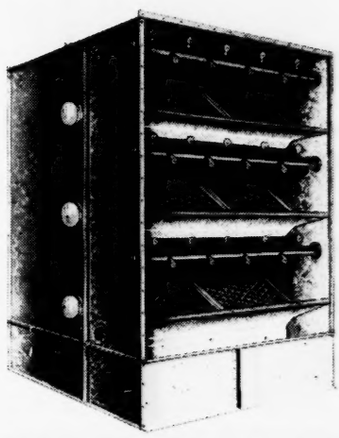

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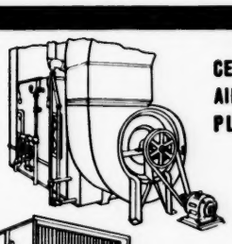

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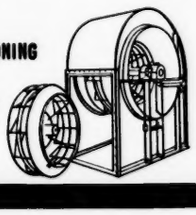

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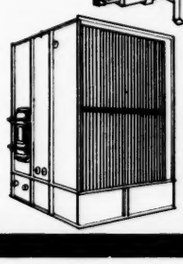

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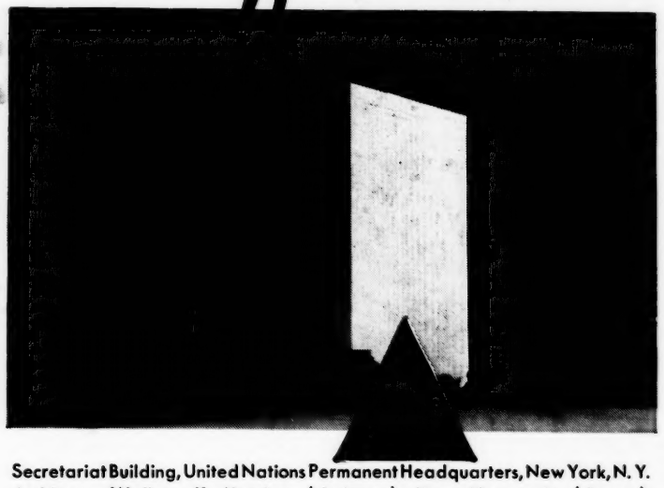

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